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CIVIL ENGINEERING.

An Extract from an Historical and Geographical Examination of the Isthmus of Panama: The different directions in which it may be cut, and the means to be employed. By MICHEL CHEVALIER. *Paris, published by Charles Gosselin, 30 Rue Jacob,* 1844.

Translated for the Journal of the Franklin Institute, by Persifor Frazer, Esq.

Nicaragua Route.

(Continued from page 310.)

At the end of the last century, some years before the French revolution, ideas of improvements were every where springing up. The government of Spain had a level carried across between the gulf of Papagayo and lake Nicaragua, coming out on the lake in the neighborhood of the important town of Nicaragua, which has, at this time, a population of at least 20,000 souls. This was the first knowledge they had of the elevation of the lake above the ocean. The engineer Don Manuel Galistro found that the distance from the ocean to the lake was 27,592 metres (30,175 yards). That the summit of the ridge was 83·70 metres (274·61 feet) above the ocean, and 43·70 metres (143·37 feet) above the lake; giving 40 metres (131·24 feet) as the height of the lake above the ocean. Between the lake and

the Pacific, the excavation of a canal drawing its water from the lake, would meet with no difficulty, except on a length of 8000 metres (8750 yards), separated from the lake by a distance of 2·50 kilometres (1·55 miles). On this length of 8000 metres (8750 yards), the elevation of the surface above the lake is, at the least, 20 metres (65·5 feet). At one point it falls to 15 metres (49·20 feet); this is at a distance of five kilometres (3·10 miles) from the lake, and up to this point, the maximum elevation does not quite attain 30 metres (98·50 feet). After this depression, the ground rises gradually and attains a height above the lake of 44 metres (144·33 feet); this point is 9300 metres (10,170 yards) from the lake. There are but 2850 metres (3117 yards) along which the height is 30 metres (98·42 feet) or more above the lake, and only one-fourth of this space of 2850 metres exceeds 40 metres (131 feet) in height. Under such circumstances a tunnel is generally pierced, for trenches of a depth of 44 metres (145 feet) are rarely cut—we should say 50 metres (164 feet), taking into account the depth of the bottom of the canal below the surface of the lake—generally, they do not exceed 20 metres (65·60 feet).

To undertake, and to complete, such a trench as that of Huehuetoca, cut with the view of draining the lakes in the neighborhood of the city of Mexico, whose depth, for a length of 800 metres (2625 feet), is from 45 to 60 metres (147 to 197 feet), and for 3500 metres (3827 yards) from 30 to 50 (98 to 164 feet), required such treasures as were at the disposal of the viceroy of Mexico the recollections of the ancient Castilian grandeur, and perhaps, also, the inexperience of Spanish engineers, as regarded tunneling—its cost was immense.

At the present day, however, in a case of necessity, by using the improved means which the engineer has at his disposal, very deep trenches may be cut without any extraordinary expense, providing it is not through a very hard rock. On the canal from Arles to Bonc, for instance, the table land of Lèque has been cut through by a trench 2100 metres (2300 yards) in length, whose greatest depth is from 40 to 50 metres (131 to 197 feet). The expense was less than 4,000,000 francs (about 800,000 dollars), although it was made under the old system. At present, in deep cuttings, the soil is attacked by arms of great power. The railroad and locomotive are employed for the transport of the earth. Man has little else to to do than to dig and to load the wagons. Even this portion of the labor has been lately performed, with great economy, by a machine on the Northern Railroad. The European or American engineers to whom the opening of the isthmus may be confided, will not hesitate to undertake cuttings of 50 metres (164 feet) in depth, unless, indeed, a very hard rock shall be encountered on a large portion of the distance. For such an object as the junction of the two oceans, we may almost attempt the impossible. The results of the survey of Don Manuel Galistro were not made public until after the independence of the State of Guatimala. Mr. Bailey, an officer of the British navy, charged, by the unfortunate General Morasau, then at the head of the government of Central America, with the survey for the canal of the two oceans, discovered them in I know not what archives, and communicated them to Mr. Thompson, the British minister, who published them. But Mr.

Bailey, doubting the accuracy of this exploration, which appears not to have been made in the best manner, re-commenced it, following another line, and we are made acquainted with the result of his labors in Mr. Stephens' interesting work on Central America.

Mr. Bailey's line terminates, like the other, on the lake near the town of Nicaragua. He starts at a point on the river San Juan of the South, two kilometres (1·25 miles) from the Pacific, to which point large vessels ascend the river. He found the distance between the ocean and the lake to be but 25,935 metres (28,362 yards). The high est point of the ground, situated 6211 metres (6792 yards) from the starting point, has an elevation above the sea of 187·78 metres (616·09 feet). The elevation of the lake is 39·11 metres (128·31 feet), and, consequently, it is 148·67 metres (497·77 feet) below the highest point of the line. The space between is quite level. According to a profile of the canal given by Mr. Stephens, after the topographical data of Mr. Bailey, the canal would rise from the lake to fall again towards the ocean. For the first 13 kilometres (7·50 miles) on the lake side, there would be but one lock to overcome a rise of 2·97 metres (9·75 feet); then, on a distance of 1600 metres (1750 yards), six or seven locks would be required to ascend 19·52 metres (64·04 feet). This would bring us to the summit level of the canal, 4800 metres (5248 yards) in length, two-thirds of which would be a tunnel, unless cuttings, of from 25 to 30 metres (82 to 100 feet) in depth, should be preferred. The height of the top of the ridge is such, that a trench from one extremity to the other of the summit level would be altogether impossible. Thence, to the Pacific, the distance is but 4800 metres (5248 yards), on which, a fall of 61 metres (200 feet) is to be provided for. Thus, according to the project published by Mr. Stephens, the canal will rise, by successive locks, 22·49 metres (72·31 feet) above the lake, to find a point where the ridge to be cut through by a tunnel will not be too wide. But in this case we would have to find, at this height, a supply of water sufficient for the demands of the canal. If, on the contrary, the canal is to draw its water from the lake, which will probably be indispensable—for there is nothing in Mr. Stephens' statement indicating other sources for supplying it—the tunnel on a level with the lake would meet the ridge at a point where it is much wider through, and instead of a length of little more than 3000 metres (3280 yards), it would have one of 5500 (6015 yards). European science does not fear to encounter such a work. At Mauvage, on the Marne and Rhine canal, there is a tunnel of nearly 5000 metres (5468 yards). The grand tunnel of the St. Quentin canal, that of Riqueval, has a length of 5677 metres (6208 yards). The summit level tunnel of the Chesapeake and Ohio canal, in America, will be 6509 metres (7120 yards) long. That of Pouilles, on the Burgundy canal, 3333 metres (3645 yards). On the English canals there are a number of tunnels of from 2000 to 4000 metres (2200 to 4400 yards). On the English railroads, we find one of 4800 metres (5248 yards), between Sheffield and Manchester, and on the London and Birmingham road, one of 2800 metres (3062 yards). The railroad from Lyons to Marseilles will also have one of great length. But the tunnel of a

maritime canal, on the extremely doubtful supposition that such a thing is admissible, would require nearly double the height and width of those in use on ordinary canals of the largest size, and that on the hypothesis, that the ships passing through are dismasted. Now, a double height and width corresponds with a quadruple section, so that, under the most favorable circumstances, the expense would be also quadruple; that is, at European prices, it would be from 4000 to 8000 francs per lineal metre, or 4,000,000 to 8,000,000 per kilometre (from about $700 to $1400 per lineal yard, or from $1,250,000 to $2,500,000 per mile). Hence, we may conclude, that Mr. Bailey's line is very inferior to that of Don Manuel Galistro, and even that it is inadmissible for a maritime canal.

Of the other routes, precise information is wanting. We know only that from Moabita, the port at the north-west point of lake Leon, to Realejo, the distance is 55 kilometres (34 miles); and to Tamarindo, 14 or 15 (8·75 to 9·25 miles); and that the ground appears favorable for the work. The whole of this country is yet to be explored. These regions, so important to the commerce of the world, so attractive from their beauty, their fertility, and the charm of their climate, have been less frequented by travelers capable of appreciating them, and by men of science, eager in the pursuit of the secrets of nature, than the inhospitable steppes of Tartary, the burning deserts of Africa, or the icy regions of the poles. A description of Mexico and Guatimala, published in Boston, in 1833, (vol. ii., p. 285,) states that the ridge between lake Leon and the Pacific ocean sinks to an elevation of 15·55 metres (51 feet) above the lake. The author adds, that from the lake to the river Tosta, the distance is but 19 kilometres (11·75 miles), and that this river, at a point at which it may be struck, is 91 centimetres (3 feet) above the lake. These facts, should they be verified, are very important. They render unnecessary a cutting of unusual depth, and still more, a tunnel; for a cutting with a maximum depth of 22 metres (72·17 feet) is nothing out of the usual practice of engineers. This book does not mention its authority for the information it gives the public, and I have found no trace of it elsewhere. Nevertheless, when we unite the unanimous testimony of Dampier, of Rouhard, of Dumartray, and of Mr. Stephens, we can hardly refuse to give it credence.

Lake Leon is 47·86 metres (157 feet) above the Pacific. This difference of level may be overcome by 15 locks—supposing that, some day, dams accompanied by locks shall be constructed, at proper intervals, on the rivers San Juan and Tipitapa, or that a lateral canal shall be dug. The canal of the two oceans, therefore, even though carried through lake Leon, will require but 30 locks; taking for granted that the ground between lake Leon and the Pacific coast will permit the opening of a canal drawing its water from the lake, and, consequently, not above its level. We cannot affirm, positively, that this is the case, but our information, from various sources, authorizes us to hope that it is so.

But the mere construction of a canal to the Pacific is not all that is to be done. We must also find a good port to which to carry it. That

of San Juan of the South, from the neighborhood of which Mr. Bailey started, and which was naturally indicated by its proximity to the city of Nicaragua,—is it good, or merely tolerable? Some represent it as an open roadstead, others as an excellent anchoring ground. Messrs. Bailey and Stephens, however, who are the latest explorers of this country, agree in speaking well of it. Mr. Stephens found it well sheltered, and Mr. Bailey, who sounded it, reports a great depth of water. It is bordered by perpendicular rocks, to which ships may moor in safety. But it is of limited extent; it is said that twenty vessels would fill it. In 1840, when Mr. Stephens visited it, it was a profound solitude—years had passed that they had not seen a sail. The ports of the gulf of Nicoya, Las Mautas, La Punta de Arenas, and Caldera, appear also to be good harbors. The port of Tamarindo, which is recommended by its great proximity to lake Leon, resembles very much San Juan of the South, according to the statements of those who have a favorable opinion of the latter. But that of Realejo merits our particular attention. Juarros, whom, on this point, no one has contradicted, thus characterizes it:—"There is not, perhaps," says he, "in the whole Spanish monarchy a better port, and in the whole world but few preferable to it. In the first place, it is so vast that a thousand vessels may find shelter in it. The anchorage is excellent throughout, and large ships may approach the quay without running the least risk. The entrance and exit are extremely easy, and no where is there to be met with such an abundance of materials for construction."

We have already seen what is to be thought of the port of San Juan at the mouth of the river of the same name. The works for a communication between the two seas would be reduced, therefore, to a short canal from one of the lakes to the Pacific ocean, and to the canalization of the rivers San Juan and Tipitapa. Nothing would be necessary to put the two extremities of the line of internal navigation in communication with the sea; that will have been already accomplished. The length of the passage from one ocean to the other will be, if terminated on the Pacific at San Juan of the South, 295 kilometres (183·25 miles); if at Tamarindo, 455 (282·50 miles); and if at Realejo, 495 (307·33 miles).

This route presents another advantage not less remarkable, and not less rare in the isthmus. It is, that the most important operations, at least those of the canal to be excavated, from one of the lakes to the Pacific, are to be carried on in a country where laborers are not wanting, and where the diseases which cut off Europeans on the Atlantic shores around the gulf of Mexico, and throughout nearly the whole extent of the isthmus, do not rage. In the supposition, the most natural one, that the canal of junction will commence at Moabita, we have, in the immediate proximity, an abundance of hands. The country, which spreads out between lake Leon and Realejo, offers neighboring centres of population in a greater number than any other portion of the ancient Spanish monarchy in America, within a radius of from 50 to 60 kilometres (31 to 37 miles) around Moabita, and still nearer to the line of the canal; there is Leon, which has 35,000 inhabitants; Chinandega, where we find 16,000; Realejo, Elviejo, and Nazarote,

which are all populous. On the southern shore of lake Leon is Managua, with 12,000 souls. Near it, at the north-west extremity of lake Nicaragua, the population is not less abundant. Independently of Grenada and Nicaragua, we may point out Mataya, with 18,000 inhabitants, and Nandaime, which is also of importance. The country, likewise well peopled, is of such fertility that it will be easy to nourish, at small expense, a numerous army of laborers. Messrs. Rouhaud and Dumartray mention tracts that have yielded as many as four crops of maize in a year. When we reflect on the striking beauty of these regions, their riches, and all the privileges which nature has so prodigally bestowed on them, we are led to regard as a presentiment the mystic hope of Columbus, which he has so naively recorded in his letters, that he had discovered the true location of the terrestrial paradise in the countries on which he had landed.

At this time, and for some years back, several individuals of the States of Nicaragua and Costa Rica, supported by their respective governments, have been endeavoring to form a society who will undertake a provisional communication between the two oceans in this direction. Their plan is to throw a barrier across the entrance of the Colorado; then to raise the level of the San Juan de Nicaragua at each of the four rapids above mentioned, so as to have on the river a regular service of steamers, to transport the merchandize, of which the port of San Juan shall be the entrepôt, to Grenada, Nicaragua, and Moabita, at the head of lake Leon. The Tipitapa would be improved in the same manner, by means of dams. The carriage-road from Moabita to Realejo would be put in order and regularly kept up. Magazines would be built at the ports of San Juan, Moabita, and Realejo. It is supposed that a sum of from 12,500,000 to 15,000,000 of francs (2,500,000 to 3,000,000 of dollars) will be sufficient for the undertaking. The persons who are endeavoring to carry out this project, think that it will be a first step towards the establishment of a maritime junction. We cannot deny that facilities of transport, such as will be afforded by steamers from the Atlantic coast into the heart of Central America, will be likely to draw into these happy and almost virgin regions many Europeans, eager in the pursuit of fortune. Central America will then cease to be a land of mystery, and its resources once developed, it will fix the attention of capitalists, and of the governments of the great powers. Moreover, is it not in the order of nature that everything must go on by degrees, and that the commencements of the vastest creations of man are often on the humblest scale?

ISTHMUS OF NICARAGUA.
Scale of 5 Centimetres to a Degree.
0 10 20 30 40 50 60 70 80 90 100 Kilometres.
1 Kilometre = ·62138 Stat. Mile.
GULF of CONCHAGUA or de FONSECA
El Viejo
Chichigalpa
Volcan de Tobca
Chinandega
LEON
Realejo
R. Tasba
Moabite
Tamarindo
LAKE LEON
Tipitapa
R. Tipitapa
Managua
Nindiri
Masaya
L. de Masaya
LAKE NICARAGUA
Nandaimi
Cinotepec
Nicaragua
PACIFIC OCEAN.
GULF OF PAPAGAYO
St. Juan del Sur
Bay of Las Salinas
R. Sapoa
P! Culebra
R. Tempisque
Nicoya
Punta de Arenas
Caldera
R. Grande
Las Manias
GULF of NICOYA
Cape Blanco
W
E
S
ATLANTIC OCEAN
Fort San Carlos
Castillo Viejo
Rapids del Toro
Rapids de Mico
Rapids de Machuca
Rapids de Las Bodas
Rio San Juan
Fort San Juan
R. Colorado
R. San Carlos
R. Serapiqui

[We re-print the following Report of the Western Railroad Company of Massachusetts, which shows the manner in which statistical information is now required by a law of that State to be given in such cases, which is well worthy of imitation elsewhere. COM. PUB.]

Annual Report of the Western Railroad Corporation, for the year 1846.

Return of the Western Railroad, under the Act of April 16, 1846, *for* 11 *months, from Jan.* 1, 1846, *to the* 30*th November*, 1846.

Capital stock,	$3,000,000·00
Increase of capital, since last report,	400,000·00
Capital paid in, per last report,	3,000,000·00
Capital paid in, since last report,	400,000·00
Total amount of capital stock paid in,	3,400,000·00
Funded debt, per last report,	4,999,555·56
Funded debt paid, since last report,	
Funded debt, increase of, since last report,	
Total present amount of funded debt,	4,999,555·56
Floating debt, per last report,	
Floating debt paid, since last report,	
Floating debt, increase of, since last report,	
Total present amount of floating debt,	
Total present amount of funded and floating debt,	4,999·555·56
Average rate of interest per annum on do.,	5·2 per cent.
Cost of Road and Equipment.	
For graduation and masonry, per last report,	3,146,494·36
For graduation and masonry, paid during the past year,	7,545·50
Total amount expended for graduation and masonry,	3,154,039·86
For bridges, per last report,	163,736·23
For bridges, paid during the past year,	
Total amount expended for bridges,	163,736·23
For superstructure, including iron, per last report,	1,031,686·08
For superstructure, including iron, paid during the past year,	22,347·38
Total amount expended for superstructure, including iron,	1,054,033·46
For stations, buildings, and fixtures, as per last report,	232,178·14
For stations, buildings, and fixtures, paid during the past year,	18,153·87
Total amount expended for stations, buildings, and fixtures,	250,332·01
For land, land-damages, and fences, per last report,	234,454·97
For land, land-damages, and fences, paid during the past year,	42,551·19
Total amount expended for land, land-damages, and fences,	277,006·16
For locomotives, per last report,	347,470·72
For locomotives, paid during the past year,	71,507·42
Total amount expended for locomotives,	418,978·14
For passenger and baggage cars, per last report,	50,418·02
For passenger and baggage cars, paid during the past year,	4,648·47
Total amount expended for passenger and baggage cars,	55,066·49

For merchandize cars, per last report,	$248,018·41
For merchandize cars, paid during the past year,	122,529·60
Total amount expended for merchandize cars,	370,548·01
For engineering and other expenses, per last report,	665,850·61
For engineering and other expenses, paid during the past year,	
Total amount expended for engineering and other expenses,	665,850·61
Total cost of road and equipment,	6,409,590·97
Cost of Albany and West Stockbridge Railroad, built and leased by Western Railroad,	1,776,197·45

Characteristics of Road.

Length of road,	117·804 miles.
Length of single track,	111·350 miles.
Length of double track,	6·454 miles.
Length of branches owned by the Company, stating whether they have a single or double track,	
Weight of rail per yard in main road,	56·50 lbs.
Weight of rail per yard in branch roads,	
Maximum grade, with its length in main road,	83 ft. per mile, 1·5 miles.
Maximum grade, with its length in branch roads,	
Total rise and fall in main road,	2087 feet.
Total rise and fall in branch roads,	
Shortest radius of curvature, with length of curve in main road,	882 feet; 490 feet in length.
Shortest radius of curvature, with length of curve in branch roads,	
Total degrees of curvature in main road,	6370 feet.
Total degrees of curvature in branch roads,	
Total length of straight line in main road,	62·935 miles.
Total length of straight line in branches,	
Aggregate length of truss bridges,	6092·50 feet.
Whole length of road unfinished on both sides,	

Doings during the Year.

Miles run by passenger trains,	215,369
Miles run by freight trains,	313,259
Miles run by other trains,	45,328
Total miles run,	573,956
Number of passengers carried in the cars,	265,664
Number of passengers carried one mile,	14,273,184
Number of tons of merchandize carried in the cars,	166,394
Number of tons of merchandize carried one mile,	15,748,223
Number of passengers carried one mile, to and from other roads,	7,042,846
Number of tons carried one mile, to and from other roads,	11,275,654
Average rate of speed adopted for passenger trains, including stops,	25 miles per hour, Boston and Springfield. 20 miles per hour, Albany and Springfield.
Average rate of speed adopted for freight trains, including stops,	10 miles per hour.
Estimated weight, in tons, of passenger trains, including engine and tender, but not including passengers, hauled one mile,	9,691,605
Estimated weight of merchandize trains, including engine and tender, but not including freight, hauled one mile,	31,952,418

Expenditures for Working the Road.	
For repairs of Albany and West Stockbridge Railroad,	$11,601·46
For repair of road, maintenance of way, exclusive of wooden truss bridges and renewals of iron,	32,495·54
For repairs of truss bridges,	11,674·13
For renewals of iron, including laying down,	24,522·12
For wages of switch-men, gate-keepers, and flag-men,	
For removing ice and snow,	2,973·94
For repairs of fences, gates, houses for flag-men, gate-keepers, switch-men, tool-houses,	
Total for maintenance of way,	83,267·19
Motive Powers.	
For repairs of locomotives,	41,209·25
For new locomotives, to cover depreciation,	7,700·00
For repairs of passenger cars,	3,394·31
For new passenger cars, to cover depreciation,	4,750·00
For repairs of merchandize cars,	21,899·75
For new merchandize cars, to cover depreciation,	10,500·00
For repairs of gravel and other cars,	
Total for maintenance of motive power,	89,453·31
Miscellaneous.	
For fuel and oil,	95,006·01
For salaries, wages, and incidental expenses, chargeable to passenger department,	22,508·18
For salaries, wages, and incidental expenses, chargeable to freight department,	63,458·63
For gratuities and damages,	7,514·91
For taxes and insurance,	1,360·49
For ferries,	2,785·17
For repairs of station buildings, aqueducts, fixtures, furniture,	16,195·02
For interest,	244,731·57
For amount paid other companies, in tolls for passengers and freight carried on their roads, specifying each company,	
For amount paid other companies as rent for use of their roads, specifying each company,	
For salaries of president, treasurer, superintendent, law expenses, office expenses of the above offices, and all other expenses not included in any of the foregoing items,	31,130·89
Income during the Year. [11 months.]	
For passengers:—	389,861·42
1. On the main road exclusively, including branch owned by company,	217,064·22
2. To and from other roads, specifying what,	172,797·20
For freight:—	459,365·18
1. On main road and branches owned by company,	156,958·68
2. To and from other connecting roads,	302,406·50
U. S. mails. Rents,	29,191·29
Total income,	878,417·89
Net earnings after deducting expenses,	221,006·52
Dividends.	204,000·00
Surplus not divided,	17,006·52
Surplus last year,	87,005·47
Total surplus,	104,011·99

Estimated Depreciation beyond the Renewals, viz:—
Road and bridges, . . .
Buildings, . . .
Engines and cars, . . .

ADDISON GILMORE,
EDMUND DWIGHT,
JOHN HOWARD,
JOSIAH STICKNEY,
STEPHEN FAIRBANKS,
JAMES RUSSELL,
ROBERT CAMPBELL,
JONA. CHAPMAN,
ABRM. H. HOWLAND.
} *Directors.*

SUFFOLK, ss. *Boston, January* 11, 1847. Then personally appeared the above named Directors of the Western Railroad Corporation, and made oath that the report, by them subscribed, was true, according to the best of their knowledge and belief. Before me,

JOSIAH QUINCY, JR.,
Justice of the Peace.

Railway Statistics.

From the *Eisenbahn-Jahrbuch* (Railway Year-book), recently published by the Baron de Reden, at Berlin, we obtain some valuable additions to railway statistics. The author is now in office under the Prussian Government, and formerly superintended the construction of the railway from Berlin to Stettin.

The analysis of accidents which occurred on railways in Belgium, England, France, and Germany, respectively, during five years, commencing 1st August, 1840, is as follows:—

	Fatal Accidents.	Total number of Accidents.
Belgium,	35	100
England,	300	1500
France,	71	220
Germany,	11	22

It appears, rom this table, that the total number of persons in any way injured during this period, in the four countries, was 1842; and of these accidents, 417, or between one-fourth and one-fifth, were fatal. The following table shows approximately what proportion of these accidents have occurred in each country, and also the annual average of accidents:—

	Fatal Accidents annually.	Total Accidents annually.
Belgium,	7 or $\frac{1}{1\frac{1}{2}}$th	20 or $\frac{1}{1\frac{1}{6}}$th.
England,	60 or $\frac{5}{7}$ths	300 or $\frac{5}{6}$ths.
France,	14·2 or $\frac{1}{6}$th	44 or $\frac{1}{9}$th.
Germany,	2·2 or $\frac{1}{3\frac{1}{3}}$th	4·4 or $\frac{1}{9\frac{1}{2}}$d.

In this table, the casualties on French lines include those of the Versailles catastrophe, by which 55 lives were lost. The accidents

on the Belgian lines, in 1843 and 1844, arose almost entirely from breakage of axles and from carriages getting off the rails.

A more accurate estimate of the relative insecurity of railways in either country is obtained by comparing the number of casualties with the total number of passengers conveyed. Taking the annual mean proportion, we get the following results, which distinguish whether the accident arose from the fault of the sufferers or of the railway managers:—

	Passengers killed from their own neglect.	Officials killed and wounded from their own neglect.	Persons killed from defective management.
Belgium,	1 in 670,000	1 in 280,000	1 in 1,690,764
England,	1 in 869,000	1 in 300,000	1 in 852,416
France,	1 in 2,157,000	1 in 5,000,000	1 in 3,465,996
Germany,	1 in 25,000,000	1 in 9,000,000	1 in 12,252,858

In this list, each country is placed in the order of the relative insecurity of its railways. The terrible disproportion in this respect, between the two former and the two latter, is very significant, and deserves careful attention. Civ. Eng. & Arch. Jour.

Notice of a Paper on the Helder or Great North Holland Canal, read before the Institution of Civil Engineers, by Mr. G. B. W. Jackson, Associate, *Feb.* 9, 1847.

This canal was constructed by the late Mr. J. Blanken, engineer, during the six years between 1819 and 1825, for the passage of frigates and first-class merchantmen, and extends from Amsterdam to Nieuwediep in the Texel. The state of the navigation through the Zuyder Sea, in the early part of the 17th century, having become so defective, in consequence of accumulated sand-banks and shoals, that camels were necessarily made use of to lift the vessel over the shallows at Pampas, thereby incurring both extreme loss of time and inconvenience, the Dutch Government deemed it necessary to consult Mr. Blanken on the possibility of remedying the evil. That engineer accordingly projected the above canal, which has three divisions, the summit level being only three feet eight inches above the outlets. Its length is fifty-one miles. It is one hundred and twenty-three feet seven inches broad at top, thirty feet ten inches at bottom, and twenty feet six inches deep. The pile-driving and boring experiment undertaken by him, to ascertain the probability of success, show that the original sea-shore, being the only really hard ground in the north of Holland, is to be met with at forty-three feet under the present surface of the ground; and as the foundations of the locks were laid nearly at that depth, the result of the experiment was considered to afford sufficient guarantee for the stability of the works. The character of the soil in that part of Holland is exceedingly treacherous, and it reflects great credit on our foreign neighbors that they were able to overcome the various difficulties with which they had to contend.

The constructions generally consist of floating and swing-bridges, tide-locks, passage-locks, &c. The floating bridges are peculiar on account of their flexibility, consisting of two platforms, one fixed to each shore, on piles, the end of each of which is worked by sets of double levers, and resting on two boats, so that when the bridge is required to be opened, both boats are withdrawn, one towards each shore. The Willem lock is two hundred and ninety-seven feet eight inches long, fifty-one feet five inches wide; the height of the lock walls being thirty-two feet six inches, and the gates being each twenty-nine feet five inches by twenty-nine feet four inches.

The total cost amounted to one million and a half pounds sterling. The time required by vessels to make the passage from Amsterdam to the Helder varies according to their size, and the means of haulage; fly-boats with six relay of four horses each, making it in ten hours, whilst large east Indiamen require two, three, and four days, according to the wind. The details of construction of the whole of the works were given very freely and with illustrated drawings. In the discussion which ensued, it was stated that the only canal in this country which could be contrasted with that of the Helder, was the Caledonian canal, which was projected upon a report by Watt, commenced by Jessop, and in a great part constructed by Telford, a few years previously to the Helder canal. The principal difference between the two consisted in the nature of the ground through which they were cut, the former being excavated entirely out of alluvial deposit, whilst the latter had to be cut out of hard gravel, and in some cases rock. An interesting account was given of the mode of forming the spot for the entrance lock at the Inverness end of the Caledonian canal. The object was to carry the work out into deep water. A large mass of earth was deposited in the sea to the full extent intended. Upon this mound a heavy load of material was laid, to consolidate the mass. After settling for a considerable time, the upper mass was removed, the excavation was made for the lock-pit, and the construction was effected with comparative facility, and had endured much rough weather since, without any symptoms of failure. The superincumbent weight which was removed being greater than any subsequent strain, there was no danger of the lock ever sinking.

On the 16th inst., this paper was continued, and treated principally of the art of building with fascine work, as practised in Holland and Germany.

The usual construction of these dykes was described to be, by sinking successive layers or beds of fascines, or faggots, of almost thirty inches thick by from eight to sixteen yards in width, and of proportionate length, weighted with gravel and stones, mingled with clay, sea-weed, and silt. These layers were continued until they reached above the sea level, when the top was constructed of more solid materials, and sometimes capped with brickwork, as the public roads were formed upon them.

The slopes of the faces of the dykes vary considerably: some of the low dykes are in section of the form of an arc of a circle of six to ten feet chord and ten inches to one foot versed sine, covered with fascine

matting, staked down upon a clay-bed. Others have a base of nineteen feet wide and five feet of a triangular section, also made up of fascines and stakes, secured by hurdles and wattling, with clay, peat, sea-shells, and sand, well rammed in, and then covered with turf. Others are formed with rows of piles, sixteen feet long, with their heads six or seven feet above the shore, joined longitudinally and laterally, by waling timber, filled in and around with fascine beds and weighted with stone. Baskets filled with sand are also used in certain situations, as well as various modifications of all these kinds of protections. It was stated that these constructions were found to succeed better, and last as long as stone, being at the same time about half the cost. Ibid.

Protracted Progress of the Railway System.

Had it not been for the force of prejudice, we might have had the railway system in active operation at a much earlier date, and that even in its present form; it was but the chance votes of one or two directors that secured its advancement in 1829. All the main lines of railway now existing were projected in 1824 and 1825, and might have been executed before 1830, instead of lingering till nearly the present day; public and legislative ignorance, however, stood in the way, and it cannot be denied that the country has thereby been kept back for many years in its prosperity and advancement. To show more fully the operation of the retarding force of prejudice, we shall give the dates of many railway inventions and the dates of their recognized use:—

1754, flanched wheels,	adopted	1815
1789, edge rails,	"	1815
1803, malleable iron rails,	"	1830
1820, parallel rails,	"	1835
1804, locomotive engines,	"	1821
1805, ditto for passengers,	"	1830

In 1804, we had malleable iron rails, flanch wheels, and the locomotive. We had, in fact, all the elements of the railway system; and had they then been fully adopted, their development must have been much more rapid than it has since been. In 1814, a speed of 20 miles an hour would have been gained by George Stephenson, and we should be at least 20 years in advance. Every part of the system has, however, been kept back by errors and prejudice; and the exertions of Richard Trevithick and George Stephenson retarded by the ignorance and want of reasoning power of their professional brethren. No theorem can be proved more effectually than that the railway system of 1825–1835 might have been carried out in 1805–1815, and it presents one of the clearest cases to be found in economical history of the prejudicial postponement of a valuable institution.—*Railway Register.* Lond. Mining Jour.

Iron Bridge Rails.

We understand that Mr. Wood, of the British Iron Company's Works, Abersychan, succeeded in rolling, during last week, bridge rails weighing 90 lbs. per yard, 30 feet long; and finer and more perfect rails, a correspondent asserts, were never seen. This is but one of the many instances in which Mr. Wood has proved his great skill and extensive practical knowledge of the manufacture of rails and other iron, as well as the *minutiæ* of the iron manufacture generally —as the workings for which this establishment is celebrated fully testify. Ibid.

AMERICAN PATENTS.

List of American Patents which issued in the month of May, 1846,—*with Exemplifications, by* CHARLES M. KELLER, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For *Improvements in the Plough;* John M. May, Philadelphia, Pennsylvania, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the land-side, the bed of the share, and the standard all in one piece of sheet-metal, cut out in the manner described, so as to afford greater stability, and to reduce the cost of construction.

"I also claim making the coulter with two points and two cutting edges, and secured to the land-side of the standard, to admit of reversing end for end, and inclining the forward point up or down, for the purpose and in the manner described.

"And, finally, I claim connecting the axletree of the guide-wheels with the beam, by means of adjustable arms, to afford a means of directing the plough, as described."

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2. For an *Improvement in the Lamp for burning Lard and Oils;* John Street, Philadelphia, Pennsylvania, May 2.

This is for making the stand and the bowl of the lamp of wood, the latter being lined inside with metal; and for this purpose, the bowl, or oil receiver, is made in two parts, to admit the metal lining; the two parts of wood being then secured in any desired manner by screwing them into one another, by means of flanches.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the lamp, by making the stand and base of wood, and the bowl of wood lined with metal, as described in the specification and drawings."

3. For an *Improvement in the Machine for Bolting Flour;* Elisha S. Snyder, Charlestown, Jefferson county, Virginia, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described improvement in the machine for bolting flour, that is to say: The combination of the bran trough, elevator, and spouts with the contrary conveyor and spouts for separating the finished flour from the middlings, and conducting the flour to the discharged spout by the contrary conveyor, and the latter to the meal chest, through the openings, whence it is again elevated by the elevators and subjected to another operation in the revolving sieve; whilst the bran is at the same time mixed with the middlings and flour, being first received into the trough, and elevated thence, by the additional elevators, to the spout which conducts it to the meal chest, by means of another spout, where it is mixed with the middlings and flour, and elevated to the sieve by the elevators, by which the bran is made to repeat its office of keeping the meshes of the bolting cloth open, as described."

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4. For an *Improvement in the Wind Mill;* Allen Judd, Cabotsville, Massachusetts, May 2.

This invention consists in placing the vanes around a vertical shaft, and at a distance therefrom, and arranged with their planes tangential to the inner circumference of the rims of the wheel to which they are attached, or to some circle of less diameter, with sufficient space between each for the passage of the wind, which enters the wheel from below, and acts on the inner surfaces of all the vanes and passes out; the wheel being surrounded with two series of shutters, or blinds, one series below a floor which is on a level with the lower open rim of the wheel, and the other series above this floor, the former being thrown open on the side towards the wind, by which it enters the wheel, and those of the upper story thrown open on the other side, for the escape of the wind after it has acted on the wheel.

Claim.—"I claim as my invention, and desire to secure by letters patent, a wheel, substantially such as is herein described, having one end open for the admission of the wind, in combination with a surrounding casing, divided into two compartments and composed of shutters, one of the compartments to admit the wind to the inside of the wheel, and the other to permit its escape, all substantially as herein described."

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5. For a *Guard for preventing the passage of Air and Water under Doors;* Luther Gifford, Syracuse, New York, May 2.

Claim.—"I do not claim a flap, hinged to the bottom part of a door, or operating in vertical directions in a groove, or cavity, made therein, as heretofore used and applied to doors; but that which I do claim as my improvement, is the combination of the turning flap (applied to the door) and the shoulder made upon the threshold thereof; the said turning flap having a spring or equivalent adapted to it and the door,

for turning it, and elevating or partially revolving its lower edge above the threshold, while the operation of opening the door is being effected; and also a cam-plate, or other mechanical equivalent, applied to the door-frame, for the purpose of turning it (the flap) into a vertical position whenever the door is closed, as described."

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6. For *Improvements in the Plough;* John M. May, Philadelphia, Pennsylvania, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making the land-side, the mould-board, and posts of ploughs all of one piece of plate-metal, as described; thereby saving much expense in making, and being more firm and substantial than when made of separate pieces.

"I also claim the adaptation of a guard superficially applied to finished ploughs, as described; thereby adding to their durability, by protecting the parts most liable to wear—when removed leaving that part of the plough as perfect as when new—and which may be used or omitted at pleasure.

"I also claim the method of attaching and securing the movable progressive share, by means of the belts passing down below the mould-board, in combination with the notches in the back edge of the share, substantially as described; thereby saving (when this form of plough is used) the great expense of shares, as one progressive share equals, in service, several of the ordinary kinds.

"And, finally, I claim the method of fastening and adjusting the coulter, as described; thereby presenting, successively, a great length of cutting edge to sever obstructions before the plough."

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7. For a *Machine for Cutting Shell or Horn;* Joel R. Morse, Boston, Massachusetts, May 2.

After the shell or horn has been properly softened, it is put on to a carriage which carries it to, and against, the edge of a knive, by which it is reduced to the required thickness; and to hold it on to the carriage, with the face in contact therewith, notwithstanding the inequalities thereof, a thin, flexible plate of metal, attached to the carriage, is placed over the shell or horn, and over this another thin plate of metal, which does not move; and this last plate is borne down by a series of vertical pressers, forced down each by a separate spring, to act on the unequal surface of the shell or horn, and thus make one surface level with the surface of the carriage, so that the knife shall only shave off the surplus thickness.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement for carrying the shell to the knife, upon a carriage, in connexion with the method of holding the shell steadily upon the carriage, by means of the disconnected upright bearings, operated upon by the springs, as herein described."

8. For *an Improvement in the Sash Fastener;* Wm. S. McLean, Allegheny, Pennsylvania, May 2.

A cog-wheel is placed in the window frame, so as to act on the sash, and on the arber of this wheel there is a ratchet-wheel, the teeth of which, on the face of the cog-wheel, receive a spring-catch, and the ratchet-wheel is prevented from turning too freely by a friction spring, so that when the cog-wheel is unlocked, by withdrawing a spring-bolt, the sash can be moved up or down, the friction spring on the periphery of the ratchet-wheel being sufficient to hold the sash in any desired position.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cog-wheel, friction ratchet-wheel, friction spring and lock-bolt, as applied to window-sash, in the manner described."

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9. For an *Improved Apparatus for Washing and Amalgamating Gold and Silver;* Daniel Asbury, Coburus P. O., Union county, North Carolina, May 2.

The patentee says,—"By the ordinary and common processes for the separation of gold and silver from their ores, by washing with water and amalgamation with mercury, there has always been a loss of both gold and silver, as well as of the mercury. In the hand rocker and long semi-circular trough, usually worked by hand, the quantity of sand and gravel which these machines can work is small, consequently, when that contains but little gold or platinum, it cannot be worked with profit; and in these machines there is a great loss of both gold and platinum, as well as quicksilver, (when that is used,) because the motion is half the time in one direction, and half the time in the other, by which the gold, &c. is prevented from subsiding, and consequently passes off with the water and sand. In the Burke rocker, there is a still greater waste of quicksilver and the precious metals. In the Tyrolese bowls, the sand and gravel subside too soon to the bottom, and prevent the contact of the gold and silver with the quicksilver. My machine, I believe, will obviate all these practical evils, which, heretofore, have attended the extraction of the precious metals from their ores, or earthy and stony mixtures; these objects I effect in the following way:—

"The moving frame, which supports the pans, is hung to two cranks on two shafts, one at each end, by the rotation of which, the required shaking motion, such as would be given by hand, is obtained."

Claim.—"Having thus fully described my improved apparatus, what I claim as my invention, and desire to secure by letters patent, is the moving frame supporting one or more pans, and moved by cranks, or other analogous device, causing them to be shaken, in the manner and for the purpose above set forth."

10. For an *Improvement in Overshoes;* Andrew Vetter, Philadelphia, Pennsylvania, May 2.

Claim.—"Having thus fully described the manner in which I form my *elastic spring shank overshoe,* I do hereby declare that I do not make any claim to the employment of strands or strips of India rubber, or of spiral springs of metal, in the quarters, or in other parts of the uppers of shoes; but what I do claim as new, and desire to secure by letters patent, is the forming of the shanks, and that part of the quarters which are commensurate therewith, of upper leather, between which and the lining, elastic strands or strips of India rubber, or spiral springs of metal, or both conjoined, are inserted and extended along, for the purpose and in the manner fully made known.

"I also claim the manner of forming a hollow heel in overshoes, by inserting a hollow metallic box, duly formed, between the two thicknesses of leather, constituting a part of such hollow heel, as described and represented."

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11. *For a Composition for Blacking;* Jos. Hayward, Cleveland, Ohio, May 9.

Claim.—"Having thus fully described my improved blacking, I wish it to be understood that I do not claim as my improvement the employment of soap in the manufacture of blacking, as that has already been done, nor the combining therewith lampblack; but what I do claim as my invention, and desire to secure by letters patent, is the combination of lampblack with an alkali, as set forth, before combining therewith the compound of potash, tallow, and oil, in the manner and for the purpose set forth, by which a smooth and durable blacking is produced."

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12. For an *Improvement in the Method of Tuning the Metallic Reeds of Seraphinas, Accordeons, &c.;* J. Shaler Ives, New York city, New York, May 9.

The patentee says,—"The object of my improvement is to simplify and cheapen the construction, and to provide means for the adjustment of the reeds, to make them 'speak;' these ends I attain by making the reeds, which are attached to the bottom of their appropriate plates, to spring up through the apertures in which they vibrate, so that, by the application of an adjustable pressure above them, their plane can be regulated relatively to the apertures with the greatest nicety, to insure their speaking and giving out the best tones, the vibration being insured for a good tone by the pressure of the spring of the reed against the presser."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is tuning metallic reeds that vibrate within the apertures for the passage of the wind, by means of adjustable pressers that act against the spring of the reeds, substantially as described.

"I also claim making the slide with the parallel spring bars or

branches, substantially as described, to insure the working of the slide without being affected by the vibration of the reed, as described.

"And I also claim making the pressure on the top of the reed, by an adjusting screw, or other analogous device, to regulate the speaking of the reed, as described."

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13. For an *Improvement in the Shovel Plough;* Moses D. Wells, Morgantown, Virginia, May 9.

The improvement here claimed is for inserting a rudder, that is, a piece of iron which projects back from the shovel of the plough, and extending down some distance below the point, to answer the purpose of a guide, to prevent the plough from deviating from the true course.

Claim.—"What I claim as my improvement, is the constructing the shovel plough with a rudder arranged in the manner described."

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14. For *Improvements in Bee Hives;* Wm. R. Kelsay, Starkey, Yates county, New York, May 9.

Claim.—"Having thus fully described the manner in which I construct, arrange, and use my combined tiers of hives, what I claim as new therein, and desire to secure by letters patent, is the manner of arranging the respective tiers of boxes, so that the upper one of each tier may be removed, and the two lowermost may be elevated and held in place, by means of the sliding rods, for the purpose of introducing an empty hive beneath them, in the manner and for the purpose set forth.

"I do not claim the arranging of the boxes in tiers one above the other, and the forming of passages between these boxes, but limit my claim to the particular combination of parts, by which this combination is rendered effective in attaining the proposed end in the manner described.

"I likewise claim the forming of a compartment below the hives, surrounded entirely by stone, or metal, and so arranged, as described, as to induce the bee moth to deposite its eggs in such compartment, where they necessarily perish, and the bees are consequently protected from this formidable enemy."

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15. For *Protecting Bees from the Moth, called "A Cloth Moth Harbor;"* Daniel Arndt, West Middletown, Pennsylvania, May 9.

This consists of an apartment lined with cloth, which the moth enters, and in which it remains, (attracted by the warmth of the cloth,) instead of passing into the hive.

Claim.—"What I claim as new, and as my invention and discovery, in the above described apparatus, and for which I ask exclusive privilege by letters patent of the United States, is the cloth moth harbor, for protecting the bees and their labors from the ravages of the moth, the moth being induced, through the warmth of the cloth lining, to deposite its eggs therein, instead of in the hive."

16. For a *Method of Propelling Boats, Railroad Cars, &c.;* Josephus Echols, Columbus, Georgia, May 9.

The patentee says,—"The object contemplated by me in this invention is to economize the power required for propelling boats, or other vessels, by making use of the resistance which the water presents to the bow of the boat in its passage, and causing it, (the water,) when being deflected, to turn a wheel which is in connexion with the paddle-wheel shaft, and thus assist the driving power, such as a steam engine, in propelling the boat. With the view to attain this end, extra water wheels have been placed at the sides of the vessels, and connected with the paddle wheels, so that the current of water set in motion by the paddle wheels should communicate motion to the extra wheels, which, by the connexion, transfer the power to the paddle wheels; but it must be obvious that this arrangement occasions an actual loss of power, for the motion communicated to the extra wheels at the sides retards the boat by a force equal to that communicated to them, minus the friction. But by placing the compensating wheel at the bow, where the water must be displaced by the bow of the boat, the deflexion of the water communicates available power to the wheel, which may be advantageously employed to aid in the propulsion of the boat, or applied to any other purpose."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a wheel, or wheels, at the bow of a boat, to be driven by the resistance of the water as the boat is forced through it, for the purpose of aiding in driving the paddle wheels, and thereby saving power, as described; or to be applied as a moving force for any other purpose on the boat, as described."

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17. For an *Apparatus for Preserving Corpses;* Robt. Frederick & G. A. Trump, Baltimore, Maryland, May 9.

The patentees say,—"Various devices have from time to time been essayed for preserving bodies after death, by the application of ice; but where applied directly to the body it was troublesome and ineffectual, wetting it, and thereby rendering it more subject to decomposition. Another process has been, to place the body in a coffin-shaped case, said case being surrounded with ice, but this method is objectionable, on account of the space that must intervene between the ice and those parts of the body most desirable to congeal. Experience has proved that it is only necessary to freeze the trunk, or abdomen, and the chest; but no apparatus has heretofore been made that would, with any degree of certainty, effect this object on all sized persons, without an immense expenditure of ice, owing to the difficulty of bringing the reservoir containing the ice in contact with the proper parts. By our invention, we effect this, and, with a very small quantity of ice, we freeze the corpse as much as is necessary, while, at the same time, our apparatus is portable and convenient."

Claim.—"Having thus fully described our improved apparatus and its application, what we claim as our invention, and desire to secure

by letters patent, is a reservoir for containing ice, having a bottom formed to fit the corpse, so that it can be placed in contact with it, in the manner and for the purpose described."

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18. For an *Improved Mode of Making Spoons, Ladles, Knives, Forks, &c.;* Walter W. Hart, Philadelphia, Pennsylvania, May 9.

The patentee says,—"The nature of my invention consists in manufacturing spoons, ladles, knives, forks, sugar-tongs, and other like articles from silver, or other malleable metals, by means of swedging, or raising, metal (which has been rolled to a uniform thickness) from a level, even surface, to an uneven surface, that the parts which are made prominent may be cut off. All the parts of the metal which are required to be made more or less thin, must be more or less raised; the more it is raised, the thinner it can be cut without cutting those parts which are intended to be left of a full thickness. The metal which is to be operated upon should be made of the same thickness as the thickest part of the spoon or other articles to be manufactured, and all the parts of the metal that is necessary to be taken off, to make it of a desirable thickness, must be forced above the common level surface, or above those parts which are to be left of a full thickness. The object of it is to raise up and cut off all those parts of the spoon (or other article to be manufactured) which, in the usual methods, are hammered thin."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the forming of spoons from plate blanks, by first striking up that part of the blank which is to form the bowl, as described, then planing off the convex side until it becomes flat, or nearly so, and finally subjecting the blank thus prepared to properly formed dies for giving shape to the spoon, all substantially as set forth."

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19. For an *Improved Turn-key for Drawing Teeth;* Hiram Todd, Columbus, Ohio, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, are the following combinations of the parts of the instrument:

"The controlling of the hook with the lever, by means of the rack, pinion and socket, spindle, and cylinder, as described and set forth in the accompanying drawings and specifications."

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20. For an *Improvement in the Machine for Cutting Meat;* Abisha Clark, Doe Run, Chester county, Pennsylvania, May 9.

A series of double-edged knives are attached to a frame that vibrates within a case provided with a series of knives on opposite sides, against which they alternately cut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a series of knives moving from side to side of a square box, or tube, as herein set forth, having stationary knives to play between, in the manner and for the purpose set forth."

21. For an *Improvement in Fastenings for Bedsteads;* John Haslet & Cornelius Devitt, Irville, Ohio, May 9.

The patentees say,—"The nature of our invention consists in connecting the rails with each other with mitre joints, which embrace a round or square part of the posts which are notched, or grooved, to receive the mitred joints of the rails, the whole being then secured by a pin for each post, which passes through the two rails at their junction, and through that part of the post embraced by the mitre joint; the said pin being parallel with one of the rails, and therefore crossing the mitre at an angle of forty-five degrees; and that part of the post embraced by the rails, if square, having two of its sides parallel with the mitre joint, and the other two at right angles thereto, so that when the whole is put together, and the pin inserted, they cannot be separated without previously removing the pin; for the rails cannot be separated from the post except by drawing them in a line at right angles with the mitre, and this would necessarily break the pin which crosses this line at an angle of forty-five degrees; and the same thing will take place if that part of the post which is embraced by the rails be round, although in a manner not so effectual as if made square."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of fastening and holding together the rails and posts of bedsteads, by means of the mitre joints of the rails let into and embracing the posts, in the manner herein described, in combination with the screws, or other fastenings, inserted in a line parallel with one of the rails, and that part of the post embraced by the mitre being either round, or square, or nearly so; and, if square, the faces being at right angles to, and parallel with, the mitre, for the purpose and in the manner herein described."

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22. For a *Machine for making Harnesses;* Samuel Wilson, Dansville, New York, May 9.

This machine is for the "purpose of edging, creasing, buffing or shaving, ovaling, rounding or forming, and pricking leather straps, and particularly for tugs."

Claim.—"I claim the manner of making the metallic bed by which the leather bed is supported, viz: in two parts, one of which is made capable of being elevated and depressed by an adjusting screw, and acting in connexion with the other as an apparatus for shaving or reducing the projecting edges or parts of the leather, as described, the metallic bed serving the double purpose of a rest for the false leather bed, and a plane, or shave, to act upon the leather, as described.

"I also claim the combination of a false leather bed with a stationary solid bed and stationary roll, or other substitute therefor, for channeling and shaping the leather, as specified.

"I also claim the combining with the bed-piece the series of adjustable jaws, or holders, which perform the double purpose of holding in place a leather bed of any required size, and of serving as guides for the passage of the strip of leather over the bed, as before explained."

23. For a *Machine for Shaving and Jointing Staves, for Barrels, &c.;* John H. Lester, New London, Connecticut, May 9.

The patentee says.—"The dressing and jointing on rived staves by machinery are operations which have heretofore presented much difficulty, and of the various attempts to attain these important ends, by means of rotating planes, none has, so far as I am informed, been successful. The difficulty arises from the fact of the uneven and crooked condition of the rived bolts, which must be dressed with the grain of the wood, and of equal thickness, and the necessity of jointing the curved edges of the staves, to give the bulge to the barrel, or cask, by a continuous movement. The dressing of staves has been essayed by two rotating planes—one to plane, or dress, the concave, and the other the convex, surface; the planes being placed one forward of the other, so that the staves pass from the one to the other; but in this there is no method by which the planes can adapt themselves to the bends and crooks of the bolts. Attempts have also been made to joint the edges with rotating planes, by placing the stave, after being dressed, on a reciprocating carriage, provided with guides to cause the rotating planes to approach towards, and recede from, each other, to give the required bulge to the staves.

"The improvements which I have made, and which I wish to secure by letters patent, remove these difficulties, and consist, first, in hanging the two rotating planes, one above the other, in a vertically sliding frame, to receive the bolt from the feeding or guide and pressure rollers, and pass them to other rollers, which deliver or conduct them to the jointing operation, the frames sliding up and down, to adapt the planes to the bends, or crooks, of the bolts, the sliding of this frame being effected by two sets of rollers hung in the frame, one forward, and the other back, of the rotating planes; and, second, in giving to the frames, in which the jointing cutter heads are hung, and run, reciprocating movements towards and from each other, by means of cam-grooves, eccentrics, cranks, or other analogous device, as the staves are fed forward by a positive motion; the continuous feeding and reciprocating motion of the cutter-heads being made to correspond."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is hanging the two rotating planes in a vertical frame, which slides freely up and down, to adapt the planes to the crooks and bends of the wood, as herein described. I claim the employment of the two sets of rollers, or either of them, running in the vertically sliding frame, in combination with the rotating planes, for the purpose of guiding the rotating planes, and adapting them to the dressing of crooked or bent staves, as herein described.

"I claim, in combination with the rotating planes, the arrangement of the three sets of rollers that guide and conduct the bolt to the rollers and rotating planes in the sliding frame, the set nearest the sliding frame having the preponderance of the one that first receives the bolt, as described, for the purpose of properly adapting the crooked or bent bolts to the action of the planes, as described.

"I claim giving to the cutter-heads, for jointing the staves, a recip-

rocating movement towards and from each other, in combination with the continuous feeding in, and movement of, the staves through the machine, as described.

"And, finally, I claim the employment of the elliptical or eccentric guide rollers, in combination with the cutter-heads, as herein described."

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24. For *Improvements in Railroad Switches;* Philos B. Tyler, New Orleans, Louisiana, May 9.

The patentee says,—"The nature of my invention consists in constructing the movable part of the switch with an additional branch rail, between which and the true switch, there is an inclined plane and a guard on the outside, so that when the switch is set wrong the cars cannot run off the track."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the switch as herein described, that is to say, the addition of the branch to the main rail, with the inclined plane for the flanch of the wheel to run upon between them, and, in combination therewith, the short rails and guard, arranged substantially in the manner and for the purpose above set forth."

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25. For an *Improvement in the Machine for Cleaning Wheat, &c.;* J. W. Howlet & F. M. Walker, Greensborough, North Carolina, May 9.

This machine consists of two circular disks, the upper one stationary, and the other a runner, similar to the runner of a mill. The stationary disk has two concentric rings projecting from its upper surface, and an outer rim, the surfaces of which are ribbed; and between these play wedge-formed, fluted rubbers, that act upon the grain. The two rings have openings in them, for the passage of the grain as it is carried by the rubbers from the centre to the periphery, where it is discharged through two spouts in the outer rim. The spouts are made in radial arms projecting from the periphery of the runner, and to the upper surface of these, projecting oblique beaters, which carry the grain around in a drum which surrounds the machine.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the revolving and stationary disks, with the rubbers, and rings, and rim, combined and operating with each other; and, in combination therewith, the arms and beaters, substantially in the manner and for the purpose herein set forth."

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26. For an *Improvement in the manner of Applying Water to Water Wheels;* J. K. Millard, Town Hill, Pennsylvania, May 9.

This is for a mode of regulating the discharge of water on to that class of water wheels, formerly known as "tub wheels," but now sometimes called "turbine wheels." The flume, which is vertical, has a bottom just above the top of the wheels, and in this there is an

annular opening corresponding with the circle of the buckets of the wheel. In this groove are hinged a series of shutters, which are suspended to a ring, which, when let down, covers entirely the annular aperture, so that, when this is raised or lowered, the shutters are opened or closed, and therefore the general aperture is regulated in proportion to the separate apertures formed by the series of shutters.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the series of shutters to regulate and direct the discharge of the water on to the buckets of the wheel, in combination with the gate to which they are suspended, and by which they are operated and protected from the too violent action of the water; this gate at the same time affording a better means of shutting off the water than could be effected practically by the shutters, as described."

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27. For an *Improvement in Pickers for Looms;* Benj. A. Holbrook, Providence, Rhode Island, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method, as fully described, of fastening raw hide pickers, by means of a rivet at the junction of the bow and stem, which has the heads all on one side, that side of the stem towards the bow being straight from end to end; when this is combined with a rivet, or other equivalent fastening, at the end of the stem, for the purpose and in the manner substantially as described."

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28. For an *Improvement in Reverberatory Furnaces for Smelting Iron;* Andrew Ellicott & John McCrove, Baltimore, Maryland, May 16.

This is for an improvement in furnaces for reducing iron ores, whose object is to facilitate and economize fuel. Two stacks are placed side by side, with a blast for each, which, as occasion requires, may be diverted in such a manner that nearly the whole blast may be directed to one of the stacks, while the charge in the other preserves sufficient heat for its stage of the process. It is believed that extracts from the patent are unnecessary.

Claim.—"Having thus fully described the manner in which we construct our double hot-blast reversing furnace, and shown the design and operation thereof, what we claim therein as new, and desire to secure by letters patent, is the manner, herein made known, of combining two reverberating chambers with a single fire chamber, under an arrangement by which we are enabled, when necessary, to direct the whole of the double blast into either of the reverberating chambers at pleasure, for the purpose set forth.

"We also claim the particular manner in which we form, arrange, and apply the hollow grate bars, and the trunk, or tube, through which they are supplied with cold air, by which arrangement, all that is necessary to insure their proper action is simply the dropping them in place side by side, as herein made known."

29. For an *Improved Hot-air Back, for Cooking Ranges;* H. H. Stimpson, Boston, Massachusetts, May 16.

Claim.—"I am aware that the fire-backs of fireplaces have been made separate, to admit of removing them when burnt out; but I am not aware that that part of the front plate of the air chamber of a range which constitutes the fire-back has been made separate from, and to cover, the hole in the front plate of the air chamber, which is cast in one piece, with the ends and part of the top and bottom.

"It will be obvious that a different result is attained by this arrangement, for the fire-back, as heretofore made, is attached all around to the fireplace, so that when the middle, which is subjected to the greatest range of heat, expands and contracts, the plate is much strained, and necessarily cracks in the middle, or opens at the joints; results entirely avoided by my improvement. I do not, therefore, claim simply making the fire-back of a separate plate, for this would not attain the end contemplated; but what I do claim as my invention, and desire to secure by letters patent, is making that part of the front and top plate of the air chamber which constitutes the fire-back separate from, and attached to, the front plate of an air chamber, cast with the ends, top, and bottom, substantially in the manner and for the purpose specified."

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30. For an *Improvement in Water Wheels;* Christopher Hand, Port Elizabeth, New Jersey, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of buckets hinged on the edge next the soling, in combination with a wheel having rims projecting from the periphery, to confine the water to the buckets, as described. And I also claim providing such a wheel with scoops, for the purpose of discharging such water as may leak through, as described."

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31. For an *Apparatus for the Cure of Spinal Diseases;* John L. Sullivan, New York, May 16, 1846, antedated November 17, 1845.

This apparatus consists of a metal strap, (hinged at the back,) that passes around the lower part of the body, just above the hips, connected, by diagonal braces, with shoulder straps, and with a windlass which lies vertically along the back, by the turning of which, a chest belt is drawn tight, or loosened, at pleasure. The lower belt is connected with the chest belt by means of levers, or braces, and with the windlass by a screw, the turning of which will either depress or elevate the windlass and its connexions. By this combination and arrangement of parts, it is declared that any part of the body can be sustained at pleasure.

Claim.—"What I claim as my invention in said machine, is the combination together of all the parts following, viz: the combination of the said windlass and its lever recipient of the force; the internal screw of said windlass, and the levers on which the said male screw bears; the combination of the said side levers themselves; the chest

belt, the windlass and its fastenings, and the belt and spring around the shoulder, and the mode of working the same together; the same being constructed substantially as aforesaid, whereby the curvative force, acting and reacting, as aforesaid, is applied substantially to cure the disease, as aforesaid; by which I effect the combined action of reducing the curvature, and, at the same time, the lifting of the chest, to make room for the reduction thereof."

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32. For an *Improvement in Sugar Pans, for Evaporating Saccharine Juices, &c.;* Alfred Stillman, New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is dividing the main pipe into two parts by a cross partition, in combination with the bent branch tubes that connect each with two divisions of the main pipe, as described, for the condensation of the steam.

"I also claim connecting the main pipe with the sides of the pan, and with the induction and eduction pipes, by means of the double stuffing boxes on each, as described, to admit of the turning of the main pipe, as described; and, finally, I claim the method of connecting the branch pipe with the main pipe, by means of socket joints, as described, in combination with the mode of securing them by means of screws passing through the main pipe and tapped into tubular nuts in, and connected with, the ends of the branch pipes by wings, for the purpose and in the manner herein described."

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33. For *Improvements in Cooking Stoves;* John Lee, Wellsville, Ohio, May 16.

The patentee says,—"Heretofore it has been found difficult to equalize heat in elevated ovens, and, in warm weather, to prevent the excessive heat consequent on the use of cooking stoves; and a difficulty has also arisen from their flues clogging with soot, so as to prevent their baking well, and in stoves where the elevated oven is used, no provision has been made, independently, for roasting. The improvements which I have essayed are for the purpose of remedying these various defects."

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is, first, surrounding the elevated oven with an air chamber between it and the flue, in the manner and for the purpose set forth.

"I also claim the scrapers placed at the junctions of the flues, so as not to impede the draught, for the purpose of scraping the revolving oven, as described.

"Lastly, I claim the combination of the oven with the revolving oven and stove, in the manner and for the purpose made known."

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34. For *Improvements in Machinery for Moulding and Pressing Bricks;* Thos. Culbertson, Cincinnati, Ohio, May 16.

The patentee says,—"My improvements are applied to a machine

for moulding and pressing bricks, patented by Parsons Owen, on the 26th day of July, 1845, which consists in arranging the moulds in a reciprocating carriage placed between two rollers, so that the clay is pressed by the upper roller (which is movable, and pressed down by weighted levers) into the moulds as they pass between the two rollers, the clay being supplied to the moulds from a hopper and clay-box, on either side of the upper roller; but this machine presents several practical difficulties: 1st, The bottoms, or followers, of the moulds are made to slide up, and are provided with projections from their underside, which run up inclined planes after the bricks have been moulded and pressed, to discharge them; this tends to cant the followers, and as all machinery for making bricks is unavoidably attended with much friction from the clay which is thrown about in the course of a short time, this part of the machine is deranged, and fails in producing good results. 2nd, The clay, after being pressed into the moulds by the roller, is carried to a knife, which cuts off the surplus, but as the knife is permanent, small stones, and other hard substances, which may, and often do, project above the upper edges of the moulds, destroy the cutting edge and frequently break the machine; the frequency of these occurrences seriously affects the operations of the machine. 3rd, No means is provided for regulating the supply of clay to the moulds, so that the bricks are of unequal density, as variations in the supply will change the quantity pressed into the moulds by the roller. 4th, No mechanical means are provided for removing the bricks after they have been forced up from the moulds. These defects and deficiencies are effectually removed, and supplied by my improvements. The first, by forcing the bricks out of the moulds by means of a vertical movement. When the carriage of moulds has moved in either direction sufficiently to have carried one set of bricks beyond the knife, the projections, or stems, of the movable bottoms, or followers, of the moulds are then above a horizontal plate jointed at each end to the arms of two arbors which are made to turn by a projection on the carriage which comes in contact with an arm on one of these arbors; this lifts the plate, which, in rising, has a horizontal movement equal to that of the carriage, so that the followers are forced up vertically, avoiding the tendency to strain their stems, or to cant them in the moulds. The second is avoided by making the knife broad, and having the back attached to an arbor provided with a weighted lever, which permits the cutting edge to rise and pass over obstructions, such as stones, &c., which otherwise would destroy the cutting edge. The third is effected by means of an adjustable gauge in the hopper, or clay-box, on each side of the pressure roller, to cut off and permit only a given thickness of clay to project above the moulds. And the fourth is accomplished by means of a bar jointed at either end to parallel vibrating arms, operated horizontally, in the same manner as the plate which lifts the followers of the moulds; this bar being provided with a sand hopper and sieve, to sand the moulds in passing over them."

Claim.—"What I claim as my invention, is, first, lifting the followers, or movable bottoms, of the moulds, to discharge the bricks by

means of a plate, or equivalent therefor, which, whilst it is moved up to lift the follower, has a horizontal movement with the carriage, to avoid all strain on the moulds and their followers, substantially as described.

"Second. Hanging the knives for cutting off the surplus clay on journals, to admit of the passage of stones, or other hard substances, in combination with the movable moulds, as described.

"Third. The employment of the gauge, in combination with the pressure roller and hopper, or clay-box, to determine the quantity of clay which shall pass under the roller, as described.

"Fourth. The employment of the movable bar for removing the bricks, in combination with the carriage of moulds, as described, and in combination with this, the sand hopper and sieve, attached to, and moving with, the bar, as described."

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35. For an *Improvement in Stoves;* Laban Morse & Whitman J. Lewis, Athol, Massachusetts, May 16.

The object of this stove is to burn saw-dust, tan, and other substances, in a comminuted form.

The stove is the usual vertical cylinder stove, with what the patentee calls an air distributor within, which is simply a hollow vessel, extending up from the grate to the top of the fuel, with lateral holes for the discharge of air into and through the fuel.

Claim.—"What we claim as our invention, is the air-distributor, as arranged, constructed, and combined with the stove, and used substantially in the manner and for the purpose as above specified."

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36. For an *Improvement in Andirons for Fireplaces;* John R. Remington, Lownds county, Alabama, May 16.

The patentee says,—"The nature of my invention consists in forming that portion of the andiron which sustains the fuel into a box, that shall receive from the corners of the fireplace the air which usually goes up the chimney and tends to decrease the draught and prevent, or retard, the ignition of the fuel, and directs it, when heated, under the centre of the fire, by which a more perfect combustion of the fuel is obtained, and all tendency to smoke is prevented."

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is constructing the andiron in the manner described, so as to form an air-box in the corners of the fireplace, as above set forth."

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37. For an *Improvement in the Smut Machine;* Henry Staub, Martinsburg, Virginia, May 16.

Claim.—"Having thus fully described the construction and operation of my machine for cleaning wheat, I would observe that I do not claim the use of beating wings with roughened surfaces, for cleaning wheat of smut, garlic, &c.; but what I do claim as my invention, and

desire to secure by letters patent, is the giving the face of the beating wings of my improved smut machine a rough and sharp cutting surface, by covering them with a series of saws overlapping each other, and arranged substantially in the manner set forth."

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38. For *Improvements in Machinery for Making Wrought Nails;* Albert W. Gray, Middletown, Vermont, May 16.

Claim.—"Having thus fully described the respective parts of my machine for making wrought nails, what I claim as new therein, and desire to secure by letters patent, is the manner set forth of drawing out the nail rods, by means of a series of rollers on the ends of arms attached to a revolving shaft, which rollers operate on the rod as it lies on a yielding die, constructed and operating substantially in the manner made known.

"I also claim the employment of the spring tongs, which are made alternately to open and close, so as to grip and liberate the nail rod, and to slide back and forth, in the manner and for the purpose described; and these I claim whether the respective parts thereof be formed and operated precisely in the manner described, or in any other in which the same ends are attained by means substantially the same.

"There are some points of novelty in the heading apparatus used by me, but in its general features it is like some other machines used for the same purpose, and its parts may admit of several different modifications. I do not think it necessary for me, therefore, to make any claim to this particular instrument; but I have described it particularly as making a component part of the general machine, so arranged and combined as to co-operate therewith in a very advantageous and convenient way."

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39. For *Improvements in the Process for Manufacturing Iron directly from the Ore, and in the Apparatus therefor;* J. F. Winslow, Troy, New York, May 16.

The patentee says,—"My improved process is applicable to the treatment of oxides of iron only; and this I effect in reverberatory furnaces, although some parts of the process may be applied in furnaces without the reverberatory feature.

"It has long been essayed to reduce the oxides of iron directly into the metallic state by heating the ores mixed with carbonaceous matter, with the view to produce deoxidation, and then to transfer the mass thus treated to the puddling process; but in all these, which have so far been unsuccessful, the upper stratum only of the mass of ore and carbon was exposed to the direct action of the heat and flame, instead of the whole mass; and to avoid this evil, it has been suggested to apply heat to the mass of ore and carbon below as well as above, by placing the fire grate directly under the furnace hearth, or floor, and then reverberating the flame and passing it over the charge. This modification, while it removes the leading objection of the process

above indicated, introduces practical difficulties of such magnitude as to defeat the contemplated object.

"My improvements effectually avoid these difficulties, and consist in exposing the mass of pulverized ore, mixed with carbonaceous matter to the combined action of a gentle flame, or heat; and currents of heated air passing through the mass, which, in their passage, not only agitate the mass to aid the mechanical liberation of the gases evolved, but aid in evolving the gases from the oxide and carbon, which, in their nascent state, combine and revive the metallic particles.

"The mass is then subjected to the combined action of a more intense flame, and to highly heated currents of carburetted hydrogen gas, that pass through the mass and take up the remaining oxygen of the ore, and revive the metallic particles; and then the mass passes to the puddling process, where it is subjected to a still more intense heat, and to the action of jets of highly heated atmospheric air, to consume the carbonaceous matter, and free it from other impurities. For the application of my improved process, I have made important modifications in the well-known reverberatory furnace, which, for this purpose, is made of much greater length than those heretofore used."

Claim.—"What I claim as my invention in the process of making malleable iron directly from the ore, is the passage of heated atmospheric air through the mass of ore and carbonaceous matter in the process of deoxidizing, as herein described. I claim, also, the passage of hydrogen, or carburetted hydrogen gas, through the mass, in the process of deoxidizing iron ore, substantially as described, whether this be done after the ore has been partly deoxidized by the previous part of the process or not.

"And I also claim treating the mass in the puddling chamber with a blast of highly heated atmospheric air, to consume the carbonaceous matter, substantially as herein described.

"And, in the furnace above described, I claim, as my invention, making the plate, or bed, on which the ore is placed for deoxidizing, with numerous perforations, for the introduction and passage of highly heated atmospheric air, or other gases, through the mass, for the purpose and in the manner described.

"I also claim this perforated plate, or bed, as described, in combination with the puddling chamber, as described."

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40. For an *Improvement in the Apparatus for Feeding Furnaces for Smelting;* Squire M. Fales, Baltimore, Maryland, May 16.

Claim.—"I do not claim as my invention, feeding furnaces through a feeding tunnel simply, as this has been done; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the tube and piston, for forcing in the coal, &c., in combination with the feeding tunnel and furnace, as described, whether the furnace be for smelting or for other purposes, as described."

41. For an *Improvement in Stoves;* James Wilson, New York city, New York, May 16.

Claim.—"The general course of the draught in my stove is the same with that of others previously made, and does not, therefore, form any part of my claim to novelty; but what I do claim as new, and desire to secure by letters patent, is the manner described of forming the partitions between the descending flues and the ascending flue in the rear of the oven, by means of which, I increase the radiating surface of the rear oven plate, and augment the temperature of that part."

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42. For an *Improvement in Propelling Boats;* Wm. P. McConnell, Washington, District of Columbia, May 16.

This consists of hinged paddles hung to frames that have a sliding reciprocating motion in channels under the boat, so that when moving in one direction they present their full face to the water, and feather in returning. The ends of these paddles are curved, so as to avoid too great a shock in closing. One such paddle is placed the reverse of the others, for the purpose of backing.

Claim.—"Having thus fully described the nature of my invention, and shown the operation thereof, what I claim therein as new, and desire to secure by letters patent, is the combining, in the manner described, of the propellers and the analogous backing apparatus, within cavities prepared to receive them, but which are entirely open below, the whole being constructed, combined, and operating substantially in the manner set forth.

"I also claim the giving to the leaves of said propellers a curved form, and making them elastic towards their points, in combination with the frames against which they strike, for the purpose and in the manner described."

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43. For *Improvements in Locomotive Engines;* M. W. Baldwin, Philadelphia, Pennsylvania, May 16.

Claim.—"What I claim as new, in the last described arrangement, is the connecting of the rods which are used as constituting a part of of the frame of a six or eight wheeled locomotive, as described and represented; and also the connecting rods which embrace the crank pins upon the wheel, by forming a spherical segmental shell on one end of said rods, and attaching them together, in the manner set forth, so that such rods shall not only have perfect freedom of motion, but shall also stand in a line with, or directly behind, each other, at their junction.

"I do not intend to make any claim, under either of the foregoing heads, to either of the parts of the respective devices claimed when taken individually, but I restrict the said claims to the respective combinations described; not intending, however, by this disclaimer, to limit myself to the precise form of the respective parts, but to vary these as I may think proper, whilst I adhere substantially to the principle or manner of arrangement fully made known."

44. For an *Improved Auger for Boring Earth;* Joshua Hobart, Dubuque, Iowa, May 23.

The lower plate of the auger has, in the centre, a screw similar to the body of the common wood auger, radial cutters with openings provided with valves, to admit the earth and prevent its escape when the auger is being drawn out of the hole; and for the purpose of loosening the earth, gouge-formed teeth, called ploughs, project from the under surface.

Claim.—"What I claim in the foregoing described machine, and desire to secure by letters patent, is the combination and arrangement of the several parts, to wit: the plough, spiral screw, projecting tipped knives, and valves, in their application to the mining auger."

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45. For an *Improvement in Hot-air Furnaces;* Wm. G. Wing, New Bedford, Massachusetts, May 23.

Claim.—"I do not claim the combination of the inner hot-air chamber with the smoke chamber (immediately surrounding it) and the outer hot-air chamber immediately surrounding the said smoke chamber; but that which I do claim is my aforesaid improvement, or manner of causing the air to circulate through the inner air chamber, for the purpose of protecting the bottom part or plate of the said air chamber from being too rapidly burnt out, and also for the purpose of causing the said air to absorb more heat than it would if allowed to circulate in an undivided chamber, and escape at the top thereof; my said improvement consisting in the employment or arrangement of the partitions, and induction and eduction passages of the inner air chamber, in such manner (as described) as to cause the air, which is received into the inner air chamber, to impinge in a current perpendicularly or directly upon the upper surface of that portion of the bottom plate of the said air chamber, which is exposed to the direct action of the flame from the fire-pot, or furnace, beneath it; the whole being substantially as set forth."

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46. For an *Improvement in Forge Bellows;* Jeremiah Darling, Adrian, Michigan, May 23.

Claim.—"Having thus fully described my improved bellows, what I claim as my invention, and desire to secure by letters patent, is the combination of a series of bellows on the inside of an enclosed case, and operated by a crank in the centre, substantially in the manner and for the purposes set forth."

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47. For a *Machine for Reaming the Bands of Brass Faucets;* Wm. Read, New York, May 23.

The nature of this invention "consists in the method of applying to the drill a universal joint, in such manner as to cause the drill, or reamer, to accommodate itself to the position of the faucet, insuring a

true bore at whatever angle the faucet may be with the mandrel above it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the dividing the mandrel into two parts, and connecting them by a universal joint, and applying the motion to the reamer by means of the yoke at the bottom of the lower mandrel, embracing the arms of the wrench, fitted into the head of the reamer in such manner that the reamer may only receive a revolving motion from the mandrel, but in every other motion it may act independent of the mandrel, and being tapering, and the whole length of the hole to be reamed, it may revolve in a true circle, and insure a true and correct bore, although the line of the required bore may not be exactly in a line with the main mandrel, or shaft, which gives motion to the reamer."

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48. For an *Improvement in the Machine for Excavating Ditches;* Wm. Y. Singleton, Springfield, Illinois, May 28.

The forward end of this machine is provided with cutters, to form the bottom and sides of the ditch, and from the back of this an inclined trough extends, to deliver the earth which is drawn up on it by an endless chain of conveyers, on to an endless chain at right angles, which, in turn, delivers the earth to form the embankment. The inclined trough is suspended to the standards of the carriage frame by two hangers that turn on stud pins, to admit of adjusting the cutters and trough to the required depth, &c.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable inclined trough and excavator, and revolving endless belt of conveyers working thereon, for cutting and conveying the earth, arranged and operated in the manner before described, or other mode substantially the same, with the carriage for supporting and carrying the same."

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49. For an *Improvement in the Water Wheel:* F. P. Haviland & E. Tuttle, Waterville, Maine, May 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we lay out and form the two straight sides of the buckets we use on our improved wheel, to wit: the extreme points of the buckets being placed at the distance of thirty degrees, or thereabout, from each other, their two straight sides meeting at an angle of twenty degrees, or thereabout, and their rear sides being at an angle of thirty degrees with the radius of the wheel, as laid out according to the directions, substantially as set forth."

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50. For *Improvements in the Jacquard Frame, for Weaving Figured Fabrics;* John Perrins, Philadelphia, Pennsylvania, May 28.

The patentee says,—"In the jacquard frame, as heretofore made and now used, the trap boards, through which the tail cords pass, and by which they are lifted, are each operated by separate levers,

thus requiring as many levers and separate operations as there are trap boards; and in the mode of mounting to form the harness as at present practised, each division of the tail cords (all that pass through one trap board I will call a division) is in connexion with one color only, (it will be understood that when I speak of one color only, I mean also the threads connected with the mails of one pair of lifters,) and that, as a necessary consequence, when the threads of one color (or combination of colors in a pair of lifters) are to be used to interweave the picks, the cards must be shifted and a new card presented for each pick.

"The object of my improvement is to simplify the structure and operation; first, by connecting all the trap boards, by horizontal slides, with a vertically sliding frame, operated by one single lever, so that all the trap boards are lifted together, the lifting of the tail cords being governed by the sliding of the trap boards, that are provided with notched holes through which the cords pass, so that when the trap boards are shifted, (which is done by cams on a rotating shaft, turned by the sliding of the trap board frame, or any other intermitting movement,) the knots on the tail cords, which have been shifted by the needles, are caught and lifted; and, secondly, by connecting the tail cords that pass through one trap board with the mails on two different pairs of levers, so that the mails of each lifter of one color, or one set of colors, are connected with two trap boards, and so of the other colors. The advantage of this arrangement is, that one card only is required for each lash, as the interweaving of one color can be effected by one card, in consequence of the connexion of the mails of each lifter of one color, each with two separate trap boards; while, by the old plan, it is necessary to shift the needles to interweave the same color, as the shifting of the threads of one color can only be done by shifting the needles by a change of cards, in consequence of the connexion of all the mails of one color, or one set of colors, with one trap board."

Claim.—"I am aware that one division of mails, carrying one color, or set of colors, have been connected with two trap boards, by having two sets of trap boards, one above the other, requiring separate and distinct movements to operate them, thus rendering the machinery more complex and expensive; and, therefore, I wish it to be distinctly understood that I do not claim as my invention simply connecting one division of mails, carrying one color, or set of colors; but what I do claim as my invention, and desire to secure by letters patent, is connecting each division of mails with two divisions of tail cords, as herein described, whereby I am enabled to use but one card for each lash of any number of picks, as described. And I also claim as my invention, connecting, by means of horizontal slides, all the trap boards with one vertically sliding frame, as herein described, whereby all the trap boards are operated by one lever, as herein described."

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51. For an *Improvement in Registers for Hot-air Furnaces;* Ebenezer Barrows, New York, May 28.

Claim.—"Having thus fully described the manner in which I con-

struct and arrange my apparatus for the opening and closing of the valves of registers for air-heating furnaces, what I claim therein as new, and desire to secure by letters patent, is the manner set forth of employing a hemispherical body, furnished with volute-formed openings, or threads, which receive and operate upon pins extending from the middles of the valves adapted thereto; the whole combination and arrangement, and the consequent operation of the parts, being substantially the same with that fully made known."

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52. For an *Improvement in the Ditching Machine;* J. R. Remington, Lownds county, Alabama, May 28.

The sides of the ditch are to be cut by two circular cutter wheels, and the bottom by the cutter of what is well-known as a "road-scraper," the bottom of which is inclined, to deliver the earth at the required elevation, and on this inclined bottom there are two wheels, one placed behind the other, with scrapers projecting from their peripheries, the first takes the earth from the bank, and delivers it to the second, which, in turn, delivers it at the top, to form the embankment.

Claim.—"Having thus fully described my improved ditcher, what I claim therein as new, and desire to secure by letters patent, is the combination of cutter wheels, scraper, and elevators, substantially in the manner and for the purpose above described."

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53. For an *Improvement in the Manufacture of Iron and Steel;* Charles Low, England, May 28, 1846; antedated May 25, 1844.

We are induced to insert the whole specification of this patent, in consideration of the great interest taken in the progress of improvements in the manufacture of iron, but we do not wish to be understood as expressing any opinion on the merits of the invention.

"To all whom it may concern: be it known that I, Charles Low, of Robinson's Row, Kingsland, in the county of Middlesex, in that part of Great Britain called England, have invented an improved method of making and manufacturing iron and steel, and I do hereby declare that the following is a full and exact description, that is to say, I use manganese, in the state of the black oxide of commerce, or in any other state of oxidation, plumbago, or graphite, commonly called black lead, charcoal, and nitrate of either potash, soda, or lime, that which I commonly employ is the saltpetre of commerce. These four ingredients I mix well together in the following proportions, and apply in the following manner, viz: of oxide of manganese, I take forty-two pounds; of wood charcoal, fourteen pounds; of plumbago, eight pounds; and of saltpetre, two pounds. In the blast furnace, I add to every charge of ore likely to produce four hundred and eighty pounds weight of metal, sixty-six pounds of the above mixture, either with the iron-stone, or fuel, it being immaterial which, so that the proportions are attended to and regularly applied with each charge. In the puddling furnace it can be applied with equal advantage, when the pig-iron is in a fused state, by throwing upon the surface of

the metal a few pounds at a time, say two or three, and continuing doing so at intervals of a few minutes, the puddler incorporating it by stirring it with the metal, till the whole sixty-six pounds are used, or until the metal begins to thicken, or, as the workmen call it, 'comes to nature.' It is then 'balled,' and sent to the tilt-hammer, and rollers, and put through the usual process so well understood and practised in making malleable iron. This being attended to, I have never found the result fail, but I have always obtained an iron of uniform quality, admitted to be much more fibrous, and possessing a greater tenacity than any with which it has been compared, and capable of making excellent steel by the usual process of cementation, or other process, by which steel is made.

"Another part of my invention consists in the use of the aforesaid mixture for improving the quality of iron, by being applied in any of the processes of smelting, puddling, and casting, in the blast furnace, the puddling furnace, and cupola furnace, or other furnace that may be used by the iron-master, or founder, in like proportions. as above described, adding more or less of the compound, according to the quality of the metal used, of which quality the iron-master, or founder, or his workmen, will be able to judge; but I have found the quantity above named sufficient for the worst ore or metal.

"Another part of my invention consists in the application of the above mixture to the manufacture of cast steel from malleable iron which has been made by the above processes; to effect this, I add from two to three pounds of the above mentioned mixture to every thirty pounds of steel, when in the melting-pots, during its conversion into cast steel; or the object may be more immediately effected by adding the ingredients in the same relative proportions as for steel to the malleable iron, made as above, and then the application of a moderate heat (such as a little practice will enable the workmen to ascertain) will fuse the iron in contact with the mixture; and immediately convert it into cast steel. I recommend, as the best way of preparing the ingredients for use, that they should be ground in a mill suited to such purpose; for the puddling furnace, they should be ground to a moderately fine powder, and I should prefer their being applied from the top of the furnace, through a hopper, or tube, or such like means as would spread them more evenly than if applied by hand from the furnace door. But for the blast furnace, and cupola furnace, they would be better applied in a coarser state. I have made my calculation upon 480 pounds weight of metal, having found that to be the charge of pig-iron usually applied at one time to the puddling furnace, but the workmen will have no difficulty in judging, by the working of the metal, whether a less or greater quantity of the ingredients should be used.

"Lastly, I do not claim the exact proportions as above described, as they must somewhat vary for different qualities of iron-ore and iron, or of the ingredients themselves, nor do I claim the use of any of the aforesaid ingredients separately, as they may have been made use of before; but I claim the use of them collectively, and in the proportions herein substantially set forth, in the manufacture of iron or steel, either

in the blast furnace, puddling furnace, cupola, or other furnace, or in the melting-pot."

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54. For an *Improvement in the Steam Whistle for Locomotives;* M. W. Baldwin, Philadelphia, Pennsylvania, May 28.

Claim.—"Having thus fully described the nature of my improvement in the manner of operating the steam whistle of a locomotive engine, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have combined the main valve and the whistle, and arranged the respective parts for operating said whistle, by making a perforation through the safety-valve and its stem, there being a valve closing the lower end of said opening; which valve is to be operated upon, and the respective parts arranged, substantially as described."

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55. For an *Improvement in the Balance Valves of Steam Engines;* W. H. Baker & H. R. Worthington, Brooklyn, New York, May 28.

The patentees say,—"In constructing our balanced slide valve, we so arrange the respective parts thereof as to cause the steam to operate equally on opposite sides of the sliding part thereof, allowing the steam to enter into, and escape from, the cylinder equally on each side of said valve. In effecting this, we sometimes cause the valve to slide between two stationary check-pieces in each of which are contained three openings, operating in the ordinary way for the induction and eduction of steam.

"Instead of the two stationary check-pieces above named, we sometimes employ one stationary valve seat, which is embraced on each of its sides by the slide valve, the stationary valve seat being furnished with three steam openings on each of its sides, so arranged as to produce the same result with that first named, and in a manner substantially the same; the two modes being mere modifications of one principle."

Claim.—"Having thus fully described the nature of our improvements in the manner of constructing a balanced slide valve for steam engines, what we claim as new therein, and desire to secure by letters patent, is the causing the steam to operate equally on, and through, its two opposite sides, under an arrangement of the respective parts, such as herein set forth; that is to say, by the employment of check-pieces, between which the valve may slide, or of an elevated block, on each side of which the sliding valve is to operate, together with any such modification thereof as shall be substantially the same in its structure and operation, producing the same effect by like means."

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56. For an *Improvement in Stoves;* John B. Clute, Schenectady, New York, May 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the two side flues with the vertical flues of the elevated oven."

57. For an *Improvement in the Plough Clevis;* Charles L. Meech, Preston, Connecticut, May 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making one arm of the clevis to extend back to within reach of the person who holds the plough, to which arm a regulator is attached for governing and securing the same, and thus giving any desired pitch to the plough without stopping, or checking, the team; using, for the construction of the same, the most proper, cheap, and durable material which will produce the intended effect."

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58. For a *Rotary Steam Engine;* Richard Field Stevens, St. Louis, Missouri, May 30.

The patentee says,—"The nature of my invention consists in providing an aperture, or opening, extending throughout the circumference of a wheel, and communicating with a hollow, or chamber, within, with a flexible hoop, ring, or band, which may be so applied to the said opening as to confine steam, or other moving agent, within the hollow of the wheel, in order that its power may be communicated directly to the periphery of the wheel."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a flexible hoop, ring, or band, to an opening communicating with a hollow, or chamber, in the rim of a wheel, in such a manner as to close the opening in a part of its circumference and leaving it open in the remainder, thereby allowing a communication with the chamber upon one side of the wheel, while the opposite side is closed, and the moving agent confined in such a manner that its power is expended directly and constantly upon the periphery of the wheel. The said hoop or band may be made of any flexible substance; may be made of any convenient form; may be made continuous, or jointed, or a part only of the hoop, or ring, may be used and applied to the opening, in the same manner as a portion of the continuous hoop, or ring, above described.

"The hoop, or ring, may be applied to either side of the chamber, in such manner as to produce the desired effect, operating as a circular valve."

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59. For *Improvements in Furnaces for Steam Boilers;* Henry F. Baker, Boston, Massachusetts, May 30.

Claim.—"What I claim, and desire to secure by letters patent, is one or more reverberating chambers, (made and arranged as above set forth,) in combination with the fireplace and boiler; the same being made to revolve and retain the volatile products underneath the boiler long enough to be consumed thereunder, as above explained. And I also claim the manner of arranging the air distributing boxes, with respect to the bottom of the boiler, in combination with the curved deflecting bottoms of their respective chambers, in order that the flame produced by the combustion of the volatile gases, or other matters passing over the perforated plates of said air-boxes, may be

blown in jets against the bottom of the boiler, as set forth; the said mode of arranging the said air-boxes, consisting in giving each of them an inclined position, substantially as represented in the drawings, and as above specified."

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60. For an *Improvement in the Machine for Excavating and Removing Earth;* patented by Wm. J. Otis, on the 24th day of February, 1839; D. Carmichael & J. C. Osgood, the former of Brooklyn and the latter of Chittenango, New York, May 30.

For a description of the original machine, the reader is referred to page 110 of the 25th volume of this journal, second series.

Claim.—"Having thus fully described the manner in which we construct, and operate our improved excavating machine, what we claim therein as new, and desire to secure by letters patent, is the manner herein described, in which we have connected and combined the scraper-staff, or arm, with the machine, so that it may be raised or lowered by means of the racks and pinions, (by the aid of the triangular piece,) arranged and operating as set forth, thereby dispensing entirely with the hollow mast, and with the toothed gearing and chains combined with said mast, as used for that purpose, in the original machine of Otis."

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61. For *Improvements in the Machine for Cutting the Threads of Wood Screws;* Thos. W. Harvey, New York, May 30.

The patentee says,—"The nature of my invention consists, first, in arranging the screw blanks, in a continuous row, when thrown promiscuously into a hopper, and delivering them, one by one, without the necessity of an attendant, which is effected by means of two inclined rollers, placed far enough apart to permit the shanks of the screws to hang vertically between them, so that, by their rotation and inclination, they cause the blanks to arrange themselves side by side, with the heads resting on, and the shanks hanging between, them, and thus gradually to force them towards the delivery end.

"My second improvement consists in taking the blanks from the ends of the rollers, and delivering them into a vertical conveying tube, by means of a slide which has an aperture in it that admits the blank, and by its motion, and the oblique side of the aperture, forces it, horizontally, and in a vertical position, to the aperture of the delivery tube, down which it descends, at the same time checking the further descent of the blanks between the rollers until its return, the aperture being so formed as to permit the descent of the blanks into it from the rollers before the repetition of the delivery operation.

"My third improvement consists of a pair of spring conveying fingers, which are presented to the lower end of the vertical tubes down which the blanks descend, and slightly opened by coming in contact with a projection from the lower end thereof to receive the end of the blank as it descends, and which is griped by the fingers as they are moved away; the conveying fingers projecting from a

shaft, so operated, by a slide, and a series of cams and levers, that it rotates through a part of a circle to bring the blank in a horizontal position, and then horizontally, to present the head of the blank to the gripers, preparatory to cutting the threads.

"My fourth improvement relates to the employment of gripers jointed to a chuck, or head, at the end of a hollow mandrel, and connected to one end of a sliding rod within the mandrel, the other end being connected with a slide governed by a cam, the sliding of which causes the gripers to take hold of the blank just within the head, to rotate it whilst under the operation of the chasing tool, when this is used in combination with a turn screw, that slides within, or on, the sliding rod, and forced towards the head of the screws by a spring, so that if the blank should turn in the gripers, in consequence of the bite in the chasing or threading tool, the turn-screw will be forced into the nick in the head, and there hold it.

"My fifth improvement relates to the arrangement of the thread cutter or chaser, and the sliding rest, the latter of which is secured to a sliding chasing frame or carriage, for the purpose of preventing the shanks of the screw from yielding while under the action of the chaser; which latter is also properly secured in an adjustable tool holder or head, jointed by its lower end to the chasing sliding frame, the upper end sliding on a rod secured to a sway bar, one end of which is jointed to an adjusting slide, and the other governed by a cam which gives the requisite taper and point to the screw. The chasing frame is governed in its motion by a chasing cam groove on a cylinder, the groove being so formed as to move the chasing slide to carry the cutter gradually from the commencement of the thread towards the point, with a motion so regulated relatively to the rotation of the mandrel as to give the pitch of the thread, and then moved back again for another cut, one part of the groove crossing the other for this purpose; and that part of the groove which moves the chasing slide for chasing the thread is in the form of a helix, and at the end thereof it crosses the helix with a sudden curve to run back the chaser, and at the end of the helix the groove runs into another groove, the junction of these two being provided with a sliding switch, connected with a sliding rod within the chasing cam shaft, and so governed by another cam, called the index cam, that when the thread is chased the switch is shifted, which opens this latter groove to draw the chasing frame and chaser far enough out of the way to admit of the operation of the conveying fingers to supply a new blank.

"My sixth improvement relates to the method of adjusting the motions of the chaser to the varying lengths of blanks, and to the different form of points, so as to insure the formation of good points on the screws by making the cam which governs the motions of the sway bar adjustable on its shaft.

"And my last improvement relates to the mode of changing the cams that operate the conveying fingers—the griping cam and the chasing cam—by means of an index cam, which operates sliding twitches, through the intervention of sliding rods, within the hollow mandrel and the cam shafts.

"By means of these improvements I constitute an automatic machine, which performs all the operations of arranging the blanks in regular order, supplying them one by one, conveying them to the gripers, chasing the thread with any desired taper and point, and discharging the chased screw, with no other human labor than is necessary to keep the mechanism in order, and to throw a large quantity of blanks into the hopper at given intervals."

Claim.—"What I claim as my invention in the above named machine, and desire to secure by letters patent, is—

"*First.* The method of arranging screw-blanks and all other similar articles, and regularly delivering them by means of two inclined rollers, substantially as described, whereby the rollers, by their inclination and rotation, cause the screw-blanks thrown into the hopper promiscuously at the upper end to arrange themselves with the shanks hanging in the space between the rollers and the heads resting on their peripheries, and thus gradually to descend towards the delivering end: and this I claim whether both or only one of the rollers be made to rotate, or whether the rollers constitute the bottom only or the entire hopper.

"*Second.* I claim the delivery slide in combination with the tube or any analogous device, into which the blank or other similar article is discharged, substantially as described, whereby the blanks received from a hopper or other feeder are delivered in a vertical position into a conveyer, and the further delivery from the hopper is checked until a repetition of the operation is required as described.

"*Third.* I claim so operating the fingers as to receive the blanks, &c., in a vertical and change them to a horizontal position, and move them forward to introduce them in the gripers, substantially as herein described.

"*Fourth.* I claim the gripers in combination with the sliding spring turn screw, substantially as herein described, by means of which combination the blank is prevented from turning by the turn screw in the nick, the gripers simply holding it steady and in such a central position without defacing the head and shank, and by which also the turn screw is made to enter the nick irrespective of its direction when the blank is introduced as described.

"*Fifth.* I claim governing the motions of the chaser towards and from the axis of the blank, by combining the chaser-head with a carriage and sway-bar moved by a cam, substantially as described. And I also claim connecting one end of the sway-bar with an adjusting slide, when this is combined with the chaser or chaser-head, as described, whereby the amount of taper to be given to the screw can be regulated at pleasure.

"*Sixth.* I claim changing the directions of the various cam grooves by means of sliding switches operated by sliding rods with the hollow cam-shafts, and shifted by an index cam, by which the various changes of the motions of the machine are effected, substantially as described.

"And, finally, I claim making the cam which operates the sway-bar adjustable on its shaft, substantially as described, for the purpose of adjusting the motions of the chaser to the length of the blank, to insure the proper formation of the point of the screw, as described."

62. For an *Improvement in the Plough;* David Anthony, Sen., Union Springs, New York, May 30.

We are under the necessity of omitting the claim in this case, as it refers to, and is wholly dependent on the drawings. It is limited to the combination of parts that constitute a metallic socket for fastening the beam to the handle.

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63. For an *Improvement in the Cooking Range;* Julius Fink, Philadelphia, Pennsylvania, May 30.

This range is made with the front in the form of a segment of a polygon, one face for the fire chamber and one for each of the ovens that are placed one on each side of the fire chamber, which is by this means wedged-formed, wider in front than at the back; and back of the fire chamber, and between the two ovens, there is an air heating chamber, which is thus heated by the fire back, and the two ovens.

Claim.—"Having thus fully described the construction of my improved range, and shown the manner in which the respective parts thereof are made to operate, what I claim therein as new, and desire to secure by letters patent, is the particular manner in which I have arranged and combined the two ovens, the fire-chamber and the water-back, or air-heating space between said ovens and the respective flues, as herein set forth.

"I do not claim either of these features as new in itself; but I do claim them as new and pre-eminently useful in their combined capacity."

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64. For a *Machine for Cutting Corn and Brush;* Edwin Owen, Byron, Indiana, May 30.

To one side of the forward part of a carriage are attached two knives with their edges coming together at the heel, which is placed higher than their points to make an oblique cut on the stocks, the edges having a corresponding inclination.

Claim.—"Having thus fully described my improvements and their operation, I wish it to be understood that I do not claim the diverging knives, as they have been used; nor do I claim attaching oblique knives to a carriage, for the same reason; but what I do claim as my invention, and desire to secure by letters patent, is the diverging knives fastened to a carriage, in the manner described, with their points depressed and their edges elevated, substantially in the manner and for the purpose herein set forth."

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65. For an *Improvement in the Plough;* James Johnson, Wooster, Ohio, May 30.

The land side and mould-board are each made to lap into each other near the lower edge, and higher up they have each of them a

projecting ear that laps on to each other, the brace rod that extends up to the beam being made to pass through these ears.

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is the mode herein described of connecting the mould-board and land-side of a plough, and bracing them by means of the projections, the bracing rod, and the connexion below, in the manner and for the purpose specified."

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66. For an *Improvement in the Cultivator for Cotton;* John Merril Cullen, Benton, Mississippi, May 30.

To the forward part of the plough there is a set of rake teeth, which project vertically downwards from the beam and on the land-side, and back of these a series of scrapers, but the teeth and scrapers do not extend down so low as the lower edge of the land-side.

Claim.—"Having thus described my improvements, what I claim therein as new, and desire to secure by letters patent, is the combination of the scraper, and rake or harrow, with the cultivator, in the manner and for the purpose set forth."

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67. For *Improvements in Steam Boilers;* Elkanah Ingalls, Providence, Rhode Island, May 30.

The claim refers to, and depends on, the drawings, and hence we are under the necessity of omitting it.

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68. For *an Improvement in the Rotary Steam Engine;* James Black, Philadelphia, Pennsylvania, May 30.

Claim.—"Having thus fully described my rotary engine, what I claim therein as new, and desire to secure by letters patent, is the combination of the rotary pistons with the lateral steam passages or chambers on each side of the same, in such a manner, that the steam shall pass from one chamber to another through the passages between the pistons in regular succession from the steam-pipe to the escape-pipe, at the same time acting upon the pistons, substantially in the manner herein set forth."

SPECIFICATIONS OF AMERICAN PATENTS.

***Specification of a Patent for an Improvement in the Hydraulic Ram, called "Strode's Pneumatic Hydraulic Engine," granted to* JOSEPH C. STRODE, *of East Bradford township, Chester county, State of Pennsylvania, March 27th,* 1847.**

The nature of my invention and improvement consists in making use of a column of condensed air between the propelling fluid and the fluid that is to be raised; said air being condensed in a pyramidal-

shaped chamber, by means of the momentum of a descending column of water; said chamber having a communication, by a small opening at its top, with another chamber, into which the spring water, or fluid to be raised, is introduced, called the spring water chamber, and upon which the condensed air in the first named chamber is made to act, causing said fluid to rise through a tube placed in the spring water chamber, (open at its lower end, and closed alternately at its upper end, by means of a valve,) into a large air vessel, or receiver, of the usual form and construction, being conducted thence to its place of destination by pipes, or hose, in the usual manner.

Fig. 1. Fig. 2. Fig. 3.

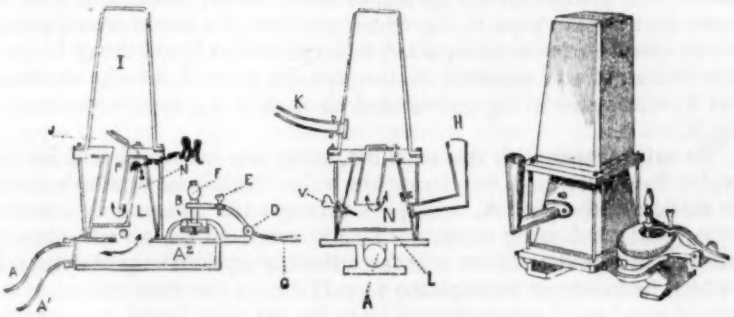

Fig. 1 is a longitudinal section.
Fig. 2 is a transverse section.
Fig. 3 is a perspective view.

Similar letters in the several figures refer to corresponding parts.

A is the main pipe for conducting the propelling water from the head, or reservoir, to the pyramidal air chamber. This pipe descends below the level of that portion of it which connects with the air chamber just before it reaches the said chamber, and then ascends, in a curved line to it, forming a curved bend in the pipe, as at A', for the purpose of preventing the air received at the valve B, during the time in which the vacuum is produced in the air and water chamber, as hereafter described, from filling the pipe A, as the air will not descend at said bend in the tube, so that the surplus of said air, after having filled the condensing chamber L, may be carried off, by the current of water, through the valve B.

The pipe A is enlarged below the air chamber L, as at A^2, and has an opening O into the air chamber L, through which the water passes when the valve B is closed.

B is a valve attached to a curved, vibrating lever C, turning on gudgeons D, in boxes, as its fulcrum, having a set screw E, for regulating the descent of the valve, and a counter-balance F, for adjusting the valve. When this valve B is down, as shown in fig. 3, the water from the head flows through the opening, which it closes; when it is up, as shown in fig. 1, the water rises into the pyramidal chamber L, through the opening O, and condenses the air therein.

H is a pipe for conveying the spring water to the spring water

chamber. I is the air chamber into which the water is forced. J is the valve for holding it. K is a pipe, or hose, for conveying the water to its place of destination. The above named parts, lettered from A to K, inclusive, are made and operated in the usual manner. The improvements are as follows:

L is a pyramidal chamber into which air is admitted through the valve B, when it descends by the pressure of the external air, to supply the partial vacuum created in the pipe A, and chambers L and N.

This pyramidal chamber has a communication, by a small opening M at the top, with another chamber N, called the spring, or pure water, chamber; through which opening M, the air, so condensed, is forced, and presses on the spring, or other water, introduced into the same through the pipe H, by which pressure, the water in said spring water chamber is forced upward through a tube P, reaching to near the bottom of said chamber N, through the valve J, into the air chamber I; said valve being represented as open in fig. 1, and as closed in fig. 2.

To raise water with this machine, open the valve B, and let the water flow out; then, by closing the valve B, the water, which is now in motion in the pipe A, will pass through the opening O, into the pyramidal condensing chamber L, and condense the air the same as before; the condensed air will force the spring water up the tube P, (which had entered through the pipe H during the continuance of the partial vacuum above spoken of,) into the chamber I, and condense the air therein, until its density is equal to that in the condensing chambers L, and N, below; at this time the spring water will cease to flow into the air chamber I, the valve J closes, and the air in the chambers I, L, and N commences expanding, that in the lower chambers, L and N, giving motion to the propelling fluid and driving it backward, producing a partial vacuum in the machine, and the air in the upper chamber I, forcing the spring water to its place of destination.

The said partial vacuum in the machine, caused by the reaction of the machine, as aforesaid, and the pressure of the external atmosphere on the valve B, will cause it to open again. The water from the head then flows through this valve with an accelerating movement, until it has acquired that degree of velocity as to cause the valve to close. The water having no longer any vent through the valve B, passes through the opening O into the pyramidal air chamber L, and repeats the operation above mentioned successively.

In this manner the operation will continue as long as the machine remains in order and there is a head of water to propel it. The valve V is for the purpose of supplying the chamber I with air, by admitting said air into the tube P. The said air is admitted during the time that the partial vacuum above mentioned takes place. The air thus introduced into the tube P ascends to the top of the same, and is forced into the chamber I at the next stroke of the machine; said valve V is represented open in fig. 2, and may be closed, or regulated, by screwing the thumb-screw V.

The principal advantages this machine possesses over other machines are,

1st. In case of forcing up pure water by the propelling power of a running stream of water less pure, there is no possibility of the impure water mixing with the pure, there being at that time a column of condensed air between the two waters.

2nd. The water being forced into the upper chamber I, by the condensation of air in the lower chamber, the valve J opens more slowly than when water alone is made the propelling medium, and also shuts more slowly, thereby preventing the water from escaping back through the valve J after it is forced up—the valve J being nearly closed when the water ceases to flow upward into the chamber L. This advantage, upon trial, is found to be of considerable importance, enabling the machine, thus operated, to force, with a given quantity of water, several barrels more of water per day than it would otherwise do.

3rd. There being no valve between the condensed air in the lower chamber and the driving water, or at the opening O, said air is permitted to act a longer time in forcing back said driving water, and thereby making a more complete vacuum than in other machines, and rendering useless the spring for opening the outlet valve B, as used in several machines.

It is not necessary that the spring water chamber N, and the air chamber L, should be enclosed by the same envelope, but they may form separate chambers, and they may be arranged in any convenient way or manner most acceptable to the constructor, provided that the capacity of the air chamber does not exceed a due ratio between the propelling power and the water to be raised.

I wish it to be understood that in the construction of these machines, I do not wish to confine myself to the form of a hollow frustrum of a pyramid, cone, or other form, for the several chambers, &c.; but I desire the privilege to vary these as I may think proper, in form, proportion, and material; provided, in all cases, that the surplus air be carried off through the valve B. I, however, prefer the forms above described when pure water is to be raised with impure water.

What I claim as my invention, and desire to secure by letters patent, is

1st. Making use of a column of condensed air between the propelling fluid and the fluid to be raised, in the manner above described, or other mode substantially the same, by which analogous results are effected.

2nd. I claim the particular combination of the pyramidal air chamber L, the internal spring water chamber N, and the water tube P, with the curved conducting pipe A', and valve B, and the air chamber I, and hinged valve J, constructed and arranged in the manner and for the purpose substantially as set forth.

Description of a Vibrating Box for Locomotive Axles, patented by Norris & Tull, *of Philadelphia, June,* 1846.

The arrangement of this box allows it to revolve in a vertical plane, at the same time that it floats up and down, the journals of the drivers having, at all times, their full bearing upon the box; let the axle assume any position from a horizontal line caused by inequalities of the road, or the consequent raising of the outer rail, in passing curves, which must necessarily reduce friction in a great degree, and insure the more perfect working of the engine, without producing any undue strain in its several parts, and has only to overcome the friction which is due to the surfaces upon which it works. This evil has always been overlooked in the construction of locomotives, and which must occur when a box floats vertically in a pedestal.

Fig. 1, plate V. Elevation of pedestal with vibrating box.

Fig. 2, Cross-section of the same.

Fig. 3, Ground plan.

Fig. 4, Vibrating box.

Fig. 5, Bearing of vibrating box.

A, A, pedestal forming part of the wrought iron frame. B, vibrating box resting with the two pivots *b*, *b'*, which are firmly attached to it in openings of the two sliding pieces, *c*, *c'*. Fig. 5 shows an end view of one of the latter, with its flanches, *m*, *m'*, and the hole, *a*, which is to receive the pivot, *b*. These sliding-pieces are connected, by means of screws, *x*, *x'*, with the cross-piece, *d*, the lower surface of which is cylindrical, and forms a bearing for the upper convex surface, *n*, *n'*, of the box, B. *f*, wedge, kept by the set-screw, *f'*, in a position which allows the box to slide in the pedestal, without being too loose or too firm. *g*, oil-box. In fig. 4, this oil-box is omitted.

The same parts are marked by the same letters in the different views.

Decision in the Circuit Court of the United States for the Eastern District of Pennsylvania, at the October Sessions, 1846, *in the case of Knight* vs. *Gavit, for the infringement of a Patent Right for Driers for finishing Paper.*

Between forty and fifty witnesses were examined. After the evidence was closed, the plaintiff contended that the specification shewed that his patent was for *a machine to finish paper by the repeated contact of heated metallic cylinders, acting, with graduated temperature and pressure, on the naked sheet, while damp, in successive stages of the drying process: with an intermediate adaptation of former modes of alternately shifting the side next to the drying surface of the cylinders;*—and that on the question of invention, or of infringement, the explanatory designation of a method of gradu-

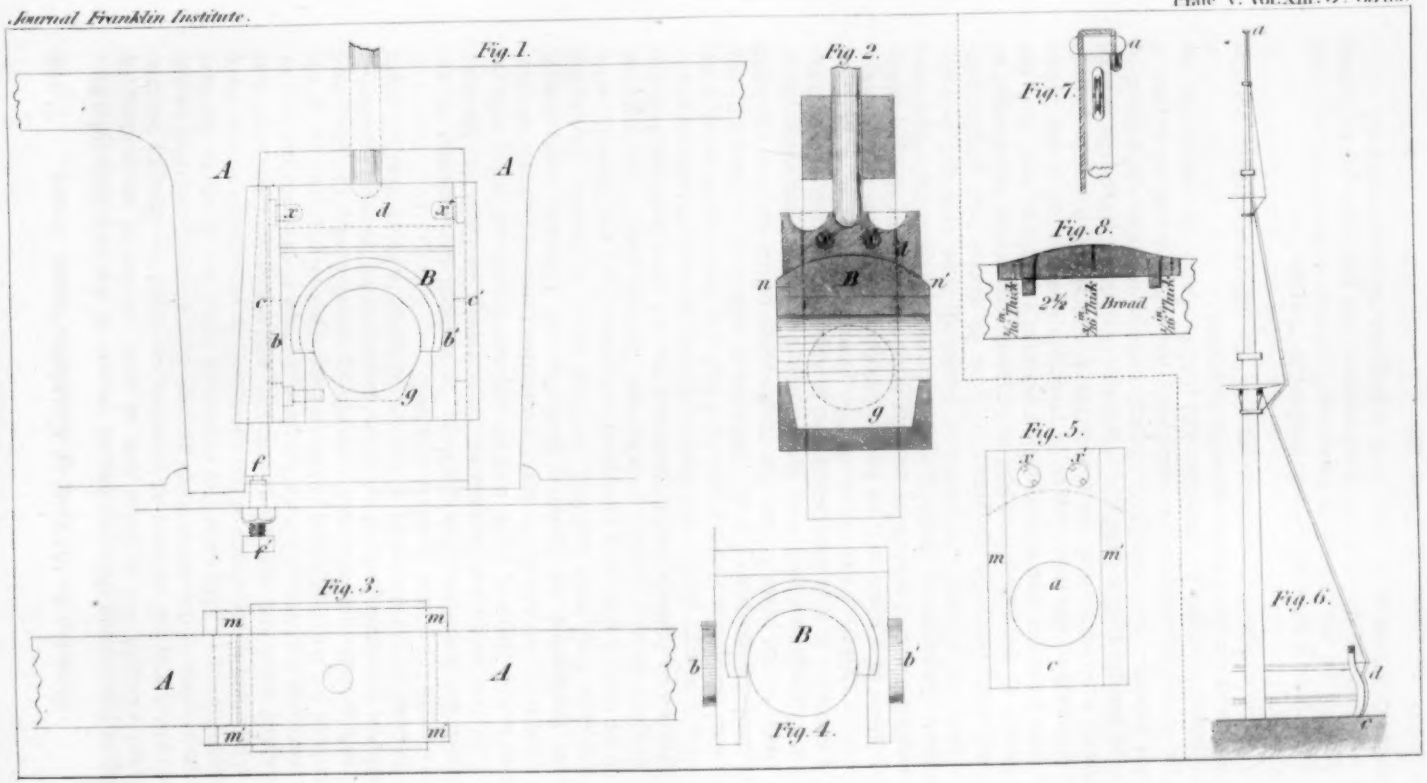
Fig. 1.
A
A
x
d
x'
B
c
c'
b
b'
g
f
f'
Fig. 2.
a
a'
B
n
n'
g
Fig. 7.
a
Fig. 8.
1/16 Thick
2 1/2 Broad
1/16 Thick
Fig. 5.
x
x'
m
m'
a
c
Fig. 6.
a
d
c
Fig. 3.
m
m
A
A
m
m
Fig. 4.
B
b
b'

ating or preventing the closeness of contact of the two first cylinders did not exclude the optional use of other modes of postponing or graduating original contact or pressure, as might be deemed best for the protection of the moist sheet against injury from premature or excessive pressure. He therefore requested the court *first*, to instruct the jury, that if the terms of art contained in the specification were ordinarily used and applied as testified, and if the jury believed that *the varying texture of the damp sheet, during the drying process*, as described by the witnesses, *rendered such repetition of contact of the driers a process adapted to the successive conditions of the sheet and useful in converting it into finished paper*, in the manner testified—the plaintiff's interpretation of the specification was correct in point of law, and his patent valid, if original.

Upon the question of originality, he insisted that, except in regard to the machines designated respectively as Carter's, Howe's, Fisher's, and Ames's, there was no testimony opposed to his title as an inventor; and asked the court's direction; *secondly*, that if the machines designated as Carter's, Howe's, and Fisher's, respectively, operated as had been testified, without such successive graduation of either heat or pressure, neither of these machines was identical with the subject of the plaintiff's patent; and *thirdly*, that if the machine designated as Ames's was constructed as had been testified, the impossibility of any similar graduation of temperature at the respective stages of dampness of the paper at which the sheet underwent pressure, and the incapacity of the machine to admit of a change of the side next to the drier during the continuance of the process, rendered this a different machine from that which was the subject of the plaintiff's patent. It was also contended in argument that if, through the failure, or defective execution, of Mr. Ames's purpose of a peculiar adaptation of a press roll, he had been obliged to resort to a remedy, through the use of which he had, by accident, and not design, made his machine perform, partially and inappropriately, certain functions to which the plaintiff's machine, as patented, was appropriately designed, and effectually adapted; still, as its casual and partial performance of these functions had not caused any public knowledge of the true principle and objects of the plaintiff's machine, and had not even conveyed the true idea of its principle to the mind of Mr. Ames himself, such accidental use of a mode of operation similar in part to that of the plaintiff's machine, ought not to deprive him of the benefit of his patent. But this point, though insisted on, was not argued at large, as the plaintiff relied confidently on the two radical points of distinction between his machine and that of Ames, on which the instruction to the jury was requested as above.

The defendant's counsel submitted the following points for the court:—

The court is requested by defendant to charge:

1. That no action can be maintained for the violation of a patent by any persons who are not the owners of the patent, or the exclusive owners of a license for the places where the violation occurred.

2. That the owners of two-thirds of a patent cannot maintain such an action.

3. That if the plaintiff has sold one-third of this patent right, formerly owned by William Knight, he cannot maintain this action.

4. That the Narr. states the plaintiff to be the sole owner of this patent, and if he is not so, this action cannot be supported.

5. That the account of the plaintiff, as assignee of his father, William Knight, sworn to by the plaintiff, is evidence that he has sold the one-third formerly belonging to said William Knight.

6. That the plaintiff's patent is for a combination only; and as all parts of the machine, separately, were known and used before, the violation must consist in the use of the combination described, and not for making the separate parts of the machine.

7. That making a machine in all respects like the plaintiff's alleged patent, in which the drying cylinders do not touch, is no violation of plaintiff's patent.

8. That making a machine with screws under the journals of the drying cylinders, so as to separate them, is no violation of the plaintiff's patent.

9. That if such a machine be made with screws under the journals, by which the drying cylinders may be kept apart, the machinist is not responsible for a violation of the patent right, although the purchaser should lower those screws, so as to allow the cylinders to come in contact.

10. That the plaintiff's patent is for drying and pressing simultaneously:

Not for changing the sides of the paper:

Nor for applying pressure at any particular stage of the manufacture:

Nor for applying different degrees of heat.

11. That if drying and pressing paper at the same time was known and used before the patent of William Knight, then his patent is invalid.

12. That a mere repetition or reduplication of a machine known and used cannot be the subject of a patent—merely because the same effect is increased.

13. That if Knight's machine is nothing but the use of two or three of Howe's machines, his patent is invalid.

14. Any use, however limited, of a machine similar in principle to the patented machine will defeat the patent.

15. The specification which describes only known and previously used parts of a machine, will not support a patent for a combination, unless the combination intended to be patented is clearly stated.

16. In Knight's patent, the only combination stated is for drying and pressing simultaneously, and therefore that is all the patent covers.

17. If a machine such as Mr. Knight's, or a combination such as he asserts he has patented, is described in the specification of a previous American patent, Mr. Knight's patent is invalid.

18. Ceasing to use a machine, or preferring the use of another ma-

chine, will not authorize another person to take out a patent therefor, although he should be a subsequent inventor thereof.

19. If the patentee claims all the machine described in his patent—as his combination—he claims too much, and upon that ground *this action* cannot be supported.

20. Damages are only for the use of machine proved—so long as it has been proved to be used.

Charge of the Court.

The court (Judge Kane) charged the jury as follows:

This is an action of trespass on the case brought by Abijah L. Knight to recover damages from Nelson Gavit, for an alleged breach of patent right.

The plaintiff has presented letters patent under the seal of the Patent Office of the United States, duly attested, bearing date 25th Sept., 1839. by which there was granted to William and Abijah L. Knight, and Edward F. Condit, their heirs, administrators, and assigns, the exclusive property in a new and useful improvement in the machine for making paper, of which a description is particularly given in an accompanying schedule.

The plaintiff claims to be at this time, and to have been at the time when this suit was instituted, the sole owner in law of this patent right; the former interest of Mr. Condit having been regularly transferred to him on the 22nd of May, 1841, and the former interest of William Knight in like manner transferred to him on the 15th December, 1842.

The latter transfer, however, was by a conveyance in trust, and the defendants have objected that, on that account, as well as because it was not recorded within the time directed by act of Congress, the conveyance did not pass such a title as would authorize the plaintiff to sue in his own name as assignee of that interest. This question, however, is one to be settled by the court, not by the jury. For the purposes of your deliberations and verdict, you will assume that the conveyance by William Knight to the plaintiff did pass to him all the legal rights of the assignor, and that, so far as this question is involved, the plaintiff must be regarded by you as if he had been named alone in the patent.

It has been contended, however, at a late moment in the cause, that the plaintiff ceased to be the owner of the interest which he derived from William Knight, at some time prior to the 28th of April, 1843, when he settled his accounts as assignee, and charged himself with the proceeds of sale of the assigned estate. You have seen the entry in the accounts, and have heard the evidence of Mr. Fallon as to the circumstances and purpose of making it. It only remains for the court to instruct you, as it does, that if, upon the evidence, you believe that no sale was in fact made to a third person, but that the plaintiff took the interest of William Knight at its appraised value, the transaction has not been such as to impair his right to maintain this action: That is to say, if you shall be of opinion that the plaintiff did, in fact, sell to some third person, at the time referred to, the interest which he had

acquired under his father's assignment, so as to pass away his legal title in that one-third of the patent, then the plaintiff has failed to establish the title which he has set forth in his declaration,* and your verdict will be for the defendant. If, on the other hand, you are not satisfied that such a sale to a third person has been made out by the evidence, then you will proceed to the further consideration of the case, leaving to the creditors of William Knight to assert hereafter, as they may do, any right they may have to a participation in the benefits of the patent right.

The question of title under the letters patent being thus disposed of, the next topic of consideration is the patent itself, its import, the adequate clearness in which it is expressed, and the utility of the improvement it professes to recognize.

The import of this patent may be determined, without difficulty, from the instrument itself, when construed according to the known rules of law. It therefore becomes the office of the court to declare what that import is; and it will be the duty of the jury to accept the interpretation, as given by the court.

In interpreting a written instrument, all its parts are to be taken together; and, in the present case, the drawing, which forms part of the specification, is to be taken with the rest.

It is obvious, that the specification and drawing before us relate to a machine of two parts, or divisions: the first of which regards the construction of wet paper from the pulp, and the second, the completion of the process of manufacture, by drying, consolidating, and finishing the material derived from the first. It is only the latter of these parts which gives rise to the present controversy, and to this alone, therefore, our inquiries must be confined.

The parts of the specification which describe this portion of the machine are found on the four last pages of the printed copy.† After describing that which may be styled the wet machine, and the progress of the pulp paper to the drying cylinders, it goes on as follows:

[With the drawing before the jury, the learned Judge here read slowly the parts of the specification referred to.]

Taking all this together, it asserts the invention, by the patentees, of a combined machine, the several parts of which are not claimed as new. The plaintiff has requested us to charge you that this combined machine "is a machine to finish paper, by the repeated contact of heated metallic cylinders, acting, with graduated temperature and pressure, on the naked sheet, while damp, in successive stages of the drying process, with an intermediate adaptation of former modes of alternately shifting the side next to the drying surface of the cylinders."

This definition the court is prepared to adopt. It is, perhaps, how-

* *Note by the Reporter.*—It had been suggested in argument, that the plaintiff, as admitted proprietor of two-thirds of the patent right, might, independently of the objection, have sued in his own name for his damages sustained as such partial proprietor, if his title had been thus set forth in the declaration. (See 11 Ad. and El. 209.)

† A pamphlet copy used at the trial.

ever, too concise to be apprehended at once clearly. The object of the machine, as we have said, is the completion of the process of manufacture by drying, consolidating, and *finishing*. It does this by employing a series of heated metallic cylinders, of which the heat is susceptible of graduation, and which are so arranged as that some of them shall be pressed upon by the others, with regulated degrees of pressure. The naked paper, while yet damp, is made to pass alternately around and between these cylinders, and is thus progressively dried and consolidated by the heat and the pressure which it derives from them through the successive stages of the process; the two sides of the paper, as it passes, being presented alternately to the heated surface of the cylinders, as in other well known machines for drying paper.

Such, in the opinion of the court, is the import of the specification for the purposes of this cause; and it submits to you that the principle of the combined machine is, therefore, the repeated action of heat and pressure, applied alternately and directly upon the material, in degrees adapted to its progressive character.

The number of the cylinders, except so far as it is implied in the successive character of their action, their exact relative position, provided it be not incompatible with the purposes for which they are employed, their precise dimensions, the fact that some of them may, at the option of the workman, be made, on occasion, to revolve without absolute contact, and the manner in which this may be effected, the arrangements for graduating the heat and the pressure; these, and numerous details, which, in the form of illustrations, suggestions of preference, or otherwise, find a place, not improperly, in the specification, are not looked upon by the court as essential parts of the machine: these regard matters independent of its principle and substantive character.

In thus defining the extent of the patented improvement, it will be observed that the court does not limit its view to the formal words of claim with which the specification closes. On the contrary, finding that those words "claim," in the name of the patentees, "the arrangement of the drying cylinders, for the purpose of drying and pressing the paper, *as herein described*," the court looks to the description thus expressly referred to by the patentees, and deduces from it, and from the drawing which makes part of it, the entire improvement which it was their object to secure to themselves by patent.

The construction of the letters patent thus given by the court, will be accepted by the jury as correct. Its errors, if they exist, can all be repaired, and their consequences be made innoxious by a revisory tribunal.

The next question is one for the jury upon the evidence before them. Is the specification, with its accompanying drawing, such a description of the patentee's improvement and of his mode of using it, as to enable any person skilled in the arts of machine building and paper making, to make, construct, and use the same? On this question, the court is not aware that it can aid the deliberations of the jury. So far as the evidence is recollected, the numerous witnesses, on both

sides, who have spoken of the patent, have none of them adverted to any obscurity in the terms of art which it employs, or to any substantial difference between the machine as described and the machine as made. The question, however, is with you. If the description and drawing are not such as might enable a skilful artist to construct the machine, you cannot find a verdict for the plaintiff.

The next question regards the utility of the plaintiff's alleged improvement. Upon this, also, you will pass as the evidence may direct you. If it be merely frivolous, or essentially pernicious, the law gives it no protection; if, on the other hand, it be practical, and not injurious to the interests of society, a difference of opinion as to its degree of usefulness, as compared with other machines, will not affect the right of the patentees. On this point, the evidence of Mr. Phelps, Mr. Moore, Mr. Thomas, Mr. Towne, and others, will present itself to your minds as entitled to very great weight.

The issuing of the patent, upon the oath of the alleged inventors, is prima facie evidence of the novelty and originality of the invention. If, therefore, upon the points which I have mentioned, the conclusions to which your minds arrive shall be favorable to the plaintiff, it will remain for him to show that his rights have been infringed upon by the defendant.

There is no dispute of the fact that, since the issuing of the plaintiff's patent, and the vesting of the title in the plaintiff, and before the institution of this suit, the defendant did make a machine for Messrs. Wilcox, of Delaware county, of which the model is before you—and which machine was, and now is, in use for drying and finishing paper. If that machine was an infraction of the plaintiff's patent, the plaintiff has made out his case, and must have your verdict, unless the defendant can show good cause to the contrary.

Was, then, the machine, made by the defendant for Mr. Wilcox, an infraction of the plaintiff's patent,—or, in other words, is it or is it not, substantially and in principle, the same which is described in the plaintiff's patent?

In determining this question, you will have reference to the import of the plaintiff's specification, as it has been presented to you by the court. Is, or is not, the machine made by the defendant, "*a machine to finish paper, by the repeated contact of heated metallic cylinders acting, with graduated temperature and pressure, on the naked sheet, while damp, in successive stages of the drying process, alternately shifting the side next the drying cylinders?*" Is it substantially such a machine.

The question is not whether the two machines are identical in form, or whether they are equally perfect in their adaptation to use. It is the commonest of all devices, with those who seek to defraud a patentee, to give a novel exterior to their piracy, to modify forms, introduce new parts, or omit old ones, to change the position of the parts, and generally to mask their violations of the patent right as best they may. Sometimes the patent machine is made better by these variations, more frequently it is made worse. But all this is not of any moment to the discussion of an alleged infraction. Courts and juries look

through the artifice of dress to the essential substance, and decide by reference to the substance alone.

This is the law in regard to combinations of machinery, as well as those which may be, in common language, spoken of as simple. All machines, for which a patent can be sustained, are, in truth, combinations of known elements; the only simple ones are those which we call the mechanical powers. The question, therefore, which you are to decide, is, whether there has been a substantial violation of the plaintiff's rights as the owner of the patented combination.

To determine this, you will compare the two machines, and will weigh the evidence of the different experts who have been examined; and having done this, you will apply the law, as laid down by the court, to your conclusions of fact.

The defendant's counsel has asked the court to charge you, that machines in which the drying cylinders do not touch, may be made without violating the plaintiff's patent. The court has no difficulty in so instructing you; regarding, as it does, the contact of the cylinders, except so far as they may be separated by the sheet which passes between them, as an essential part of the patented machine.

The court has been further asked by the defendant's counsel, to instruct you, that "making a machine with screws under the journals of the drying cylinders, so as to separate them, is no violation of the plaintiff's patent;" and "that if such a machine be made with screws under the journals, by which the drying cylinders may be kept apart, the machinist is not responsible for a violation of the patent right, although the purchaser should lower those screws, so as to allow the cylinders to come in contact."

The court is not aware that any evidence has been presented, to which the instructions asked for can properly have application. But inasmuch as the request addressed to it implies that, in the opinion of the highly respectable counsel, there has such evidence been adduced, the court will submit its views of the law on these points—the more readily, as the principles involved are, in its judgment, altogether elementary.

If the machine, as made by the defendant, was not an infraction of the plaintiff's patent, the alteration of it, by a third person, will not make the defendant liable for an infraction to which he was not a party. But if the machine, as made by him, was intended by him to operate in such a way as to violate the patent, and has, in fact, so operated, he was a party to the infraction, notwithstanding the ingenuity with which he may have sought to disguise his wrong. The introduction of screws under the journals, by which parts of the machine were for the time kept separated, which the purpose and uses of the machine required to be in contact, might be justly regarded by the jury as an illustration of this misdirected, and, in the result, profitless ingenuity.

So, the maker and vender of a patent lever watch, a combination of machinery, set in motion by a spring, and indicating the time of day by hands upon a dial plate, might infringe the patent for that in-

invention, though at the time of selling the machine, he had detached the hands from the dial, or omitted to wind up the spring.

The law would be valueless, if it could be eluded by devices like these. No machine maker, however determined to violate a patent right, would fail to leave some corner of his work unfinished, some spring unwound, some screw unadjusted, if, by so doing, he could escape the responsibilities, without impairing the profits, of his unlawful act.

The court submits to you the question, as one of fact, whether the defendant did make a machine similar in principle and substance with that of the plaintiff, as the court has defined it. If you find that he did, then the defendant is put upon his defence.

By the 15th section of the Act of Congress of 1836, the defendant, in an action like the present, is permitted to avail himself of various matters of defence, upon giving notice of them in writing to the plaintiff thirty days before the trial. Among these are included facts tending to show that the patentee was not the original and first discoverer of the thing patented, or that it had been described in some public work anterior to the supposed discovery thereof by the patentee. If, however, the defendant relies, under this section, on the fact of a previous invention, knowledge, or use of the thing patented, he is required to state in his notice of special matter, the names and places of residence of those whom he intends to prove to have possessed a prior knowledge of the thing, and where the same had been used.

In accordance with this section, the defendant, thirty days before the trial, gave notice, that the subject matter of the plaintiff's patent had been, before the time at which the patent issued, known to, and in use by, a number of persons, of whom eight were specified. No notice was given of an intention to show that the subject matter had been described in any public work before the plaintiff's supposed discovery; and no evidence, therefore, of such publication could be presented at the trial, unless by the plaintiff's consent.

Two or three books have, however, been read without objection, and are in evidence before you; and many witnesses have been examined to establish the prior knowledge and use of the machine. From all of these, the materials are presented in reasonable abundance to enable you to decide the great question of the cause, viz:—the novelty of the alleged invention.

It is not my purpose to recapitulate this evidence. The range of inquiry has been very broad; and very much of that which appeared pertinent when introduced, has been properly passed over in the argument without notice. The only machines which have been the subjects of much discussion before you, as of alleged similar character and prior date, are those of Howe, Carter, Ames, and Fisher. Upon each of these I shall make a few remarks, as introductory to certain instructions which it is my duty to give you on questions of law. For reasons not directly connected with this particular suit, it is my wish that, as far as may be practicable, the action of the jury on the merits of Knight's patent, shall be independent of any direct expression of opinion from the bench.

First, then, of Howe's machine. This has the merit, as compared with Knight's, of unquestioned priority of device and structure, and its appearance* certainly does not contradict its date. It consisted of a single pair of unpolished cylinders, heated by the rudest of all possible representatives of a steam boiler, without a safety valve, until the unconsidered contingency of an explosion suggested the substitution of hot bars of metal as a less dangerous resort. "That didn't answer, however, so well as the steam," and at last a common stove was introduced below the machine, one of the cylinders acting as a revolving smoke drum. It dried wrapping paper imperfectly—a thinner variety of coarse paper somewhat better, but not perfectly—and it would seem, that when the paper on which it was to act was thin, or less moist than common, or when the fire was good, and the potash kettle, which served for a boiler, had not been recently filled, it also pressed the paper without crushing it. It disappeared from the category of things in practical use and application, about the year 1837, when it was discarded by the proprietor, and has since remained in a lumber garret, till it came here for the purpose of this cause.

The rudeness of structure of Howe's machine, and the primitive character of its appliances, do not, however, necessarily indicate a difference of principle between it and a more highly finished specimen of art. Yet they may do so. For if the imperfection of its surface, and the want of precision in its adjustments, unfitted it altogether for the offices that are performed by Knight's machine, then it must follow that the object of Howe's machine was different, or that it failed to effectuate its object; and if so, it cannot be legally regarded as a machine known and used before the date of the patent.

It is for the jury, looking at the facts, to say whether this was a machine like Mr Knight's. Whether there was an alternating succession of drying and pressing, that repeated contact of cylinders, that graduation of the heat to the exigencies of the advancing stages of the process, which we observe in his. Whether, in a word, it was adapted to finish paper, or whether it necessarily left it unfinished and imperfect.

With reference, as we suppose, to this machine of Howe's, the court has been requested to instruct you, that "a mere repetition, or reduplication, of a machine known and used, cannot be the subject of a patent, merely because the same effect is increased."

The position is, in one sense, true. If it be intended to assert that a man who has no right to patent one machine, has no right to patent two of them, it may be conceded as indisputable. But if it be meant that a new and useful combination cannot be patented, because the parts which compose it are similar to each other, the court declines instructing you that such is the law. Nor is it, in the view of the court, an objection to the claim of a patent for such a machine, that it merely increases an effect which might be imperfectly produced by a more simple one; since it may be, and often is, the case, that the increased effectiveness of a contrivance constitutes all its value. The

* Referring to the machine itself in court.

repeated reduplication of a feather makes the feather bed—the reduplication of patches, the quilt that covers it.

We are further asked to instruct you, that "if Knight's machine is nothing but the use of two or three of Howe's machines, his patent is invalid." The answer of the court is embodied in the remarks just made.

Again, the counsel for the defence have asked us to instruct you, that "any use, however limited, of a machine similar in principle to the patented machine, will defeat the patent." As an abstract proposition, this is somewhat too broadly expressed, according to the best judgment of the court; but, if limited to the case under trial, it is certainly true that all four of the machines, which assert priority over Knight's have, according to the evidence, been so used as to invalidate his patent, if they, or either of them, can justly be regarded as the same substantially and in principle with his.

Taking these, as they appear to the court, upon the evidence, to have stood at the date of the plaintiff's patent, they may be described thus:

[The models and drawings of these several machines were before the jury.]

1. *Carter's.*—Consisting of several drying cylinders of the ordinary construction, heated by steam, not in contact with each other, with a small calender roller placed above one or more of them; the calender deriving heat only from the paper, which was itself heated by the drying cylinder, around which it passed; the paper not changing sides in its progress.

2. *Ames's.*—A single drying cylinder, of unusually large diameter, heated by steam, with a number of rollers of cloth, canvas, lead, iron, and paper, placed around it—some of them susceptible of graduated pressure, others so fixed as to be incapable of graduation. None of them heated except from the cylinder through the paper; the paper not changing sides in its progress.

3. *Fisher's.*—In which the paper passed over a heated iron drier, of some two feet diameter, between that drier and another of larger dimensions, also heated, and then around the larger drier.

If such be the evidence, of which the jury will judge, it would seem, 1. That in Carter's and Ames's machine, up to the time in question, the paper did not pass between heated cylinders at all, in that which may be regarded as the proper sense of the term, "heated cylinders;" for the rollers having no independent heat, but deriving all their heat from their contact with the paper, could never be hotter than the paper itself, and thus could not aid in drying it. 2. That in Carter's machine, if the testimony of Ayres and Lungren be correct, there was no successive pressure of heated cylinders; the contact, as in Howe's, occurring only once; and that the same is true as to Fisher's. 3. That in Ames's, though there was a succession of imperfectly graduated pressures, there could be no graduation of temperature, there being but one heated cylinder, from which all the rolls derived their heat. And 4. That in neither Ames's nor Carter's were the two sides of the paper presented alternately to the drying surface.

[These observations of the learned judge were incidentally explained by reference to the models.]

The court has indicated the particulars in which these several machines appear to it to differ from the machine of Mr. Knight. In so doing, it has not been our purpose to influence your action, but to make it more easy. You will decide, upon the evidence, whether these or any other differences exist in point of fact; and, if so, whether they are of form and proportion *only*, or of principle and substance also. If the machine devised by Mr. Knight is the same with either of those before known, this action cannot be sustained, and your verdict must be for the defendant.

Reference has been made, in the course of the trial, to a patent issued on the 8th of September, 1824, to Isaac Burbank, for an improvement in paper making, called the revolving mould. The patent itself is for an invention altogether unlike that which is here in controversy; but it is contended that Mr. Burbank has in his specification described an apparatus similar in principle to Knight's drying machine, without, however, claiming it as part of his invention. There is no proof whatever that Burbank ever made or used the machine which he so described, or that Knight ever saw or heard of the description; and the Patent Office having been burnt some three years before Knight's patent was applied for, and Burbank's patent not having been since recorded anew, there is no ground on which an inference of fact, still less a presumption of law, can rest adverse to the originality and integrity of Knight's invention. Independent of all which, the court does not feel itself justified in instructing you, that a man who patents his invention is bound to take notice, at his peril, of all that all prior patentees have seen fit to mix up with the specifications of their supposed inventions. It is enough, in all reason, for any one mind to inform itself of all the supposed inventions really patented, with their appropriate specifications.

The descriptions and drawings in the books which have been read to you, will next claim your attention. In examining them you will be careful to ascertain whether the machine for which a patent is here claimed, and not some other, differing either in its essential structure or purpose, has been the subject of description. If the plaintiff's machine had been described in some public work anterior to his supposed discovery, he cannot recover in this action.

If, on the other hand, you shall be of opinion that he, and those to whose rights he succeeds, were really the inventors of the improvement for which he holds a patent; that he has not sold his legal interest, or any part of his legal interest, in the patent; that the invention has been honestly and adequately set forth in his specification and drawing; that it is useful; and that the defendant has made and sold a machine which is substantially and in principle the same as his; in such case, your verdict will be for the plaintiff, and you will proceed to inquire what damages he has sustained.

The measure of damages, in a case like this, can scarcely be defined in precise terms. They should be compensatory, not vindictive. The object is not punishment, but it is full indemnity. The amount of

profit which the defendant has derived from the infraction, is one of the elements to be regarded; but the amount of loss and injury which the plaintiff has sustained, should be regarded also. Among other things, the expense and toil incident to the prosecution of a suit like this, ought to be fairly considered; the plaintiff ought not to be made a loser by the assertion of his rights. In the words of the law, your verdict will be for such an amount as you believe to be "the actual damages sustained by the plaintiff."

The counsel for the parties respectively have asked the court to instruct you on several legal questions. Some of them have been already adverted to. On the rest, we will now advise you, according to our best judgment.

So far as the plaintiff's points have not been answered, the jury are now instructed as follows:

1. If the terms of art contained in the specification are ordinarily used and applied as testified, and if the jury believe that the varying texture of the damp sheet during the drying process, as described by the witnesses, renders such repetition of contact of the driers, as is described in the specification, a process adapted to the successive conditions of the sheet, and useful in converting it into finished paper in the manner testified, the plaintiff's interpretation of the specification is correct in point of law, and his patent is valid, if original.

2. If the machines designated as Carter's, Howe's and Fisher's, respectively, operated, as has been testified, without successive graduation of either heat or pressure, neither of these machines was identical with the subject of the plaintiff's patent.

3. If the machine designated as Ames's was constructed as has been testified, the impossibility of successive graduations of temperature at the respective stages of dampness of the paper at which the sheet underwent pressure, and the incapacity of the machine to admit of a change on the side next to the drier, during the continuance of the process, render this a different machine from that which is the subject of the plaintiff's patent.

Of the defendant's points, the 7th, 8th, 9th, 12th, 13th, and 14th have been answered by the court in the charge already given. The 18th has also been answered, so far as it regards the case. The 1st, 2nd, 3d, and 15th points are answered in the affirmative. So, also, is the 4th, meaning, of course, the owner of the legal title; for, whatever may be the equitable rights of others, the legal owner may maintain suit.

The remaining points of the defendant are answered as follows:

5. It is evidence to go to the jury, with the other evidence that leads to the opposite conclusion. It is not conclusive: the jury are to say whether plaintiff sold to a third person, or took to himself at the appraised value: unless he sold to a third person, the action is well brought.

6. *Answered in the affirmative;* but a substantial violation is enough: the forms and proportions are not essential.

10. The court has construed the patent in the charge, and has nothing to add to what has been said.

11. His patent is not invalid on the supposition which the point presents, if the plaintiff's combination of machinery for that purpose was new.

16. Not so. The combination stated is for drying and pressing, "*as described*" in the specification, and the patent is coextensive with the specification.

17. Not so. If the patent was not on record, or known to him before his patent, it does not *per se* invalidate his patent, as to a matter not patented in the previous patent, or claimed in it as an invention of the patentee.

18. Answered in the charge, so far as it regards the case.

19. The defendant's counsel having explained this by reference to the 9th section of the Act of Congress of 1837, contends that the words "*thing patented,*" as there used, cannot, in any case, be applied to a *combination.* The instruction, as requested, is refused.

20. If the machine was never used, the damages should be merely nominal, as against the maker; if it has been sold by him and used by others, the verdict should be for the damages actually sustained by the plaintiff, without exclusive reference to the profitableness of the use by the wrong doer, or the length of time such use may have continued.

The jury found a verdict for the plaintiff. Damages $1500.*

BIBLIOGRAPHICAL NOTICE.

The Law of Patents in Foreign Countries. Translated by R. W. Urling.

We have received of C. S. Francis & Co., of No. 252 Broadway, New York, a copy of an English work, in one octavo volume of 277 pages, entitled "The Law of Patents in Foreign Countries, translated, with notes, for the information of inventors and patentees, by R. W. Urling, of Brussels, Patent Agent." We consider this book to be a valuable addition to our library, and are pleased to learn that a number of copies of it have been imported for sale, by Francis & Co. It contains clear and plain expositions, in the English language, of the patent laws of France, Belgium, Holland, Prussia, Austria, Russia, and other European countries; together with judicious advice to inventors and patentees. Much valuable information is brought together, in a small compass, from various sources, and it is so arranged as to be easy of access. So many important inventions and improvements are made by our countrymen, which are afterwards brought

* After the verdict, Mr. Wilcox, for whom the machine which formed the subject of controversy had been *made* by the defendant, paid $500 to the plaintiff: who, for this consideration, executed to him a release of his liability, in damages, for having *used* this machine, and another one, made by another machinist, on the principle of the patent—with a grant of the privilege of the future use, by Mr. Wilcox, of the *same two machines.*

into use in Europe, that a knowledge of the means by which a share of the profits of them may be secured to their originators is of great consequence. From the book before us, that knowledge may be obtained. The intercourse between Europe and America increases every year; new lines of packet ships and of steamers are established, and business relations are more and more extended. The constantly increasing stream of emigration multiplies the ties between the old and new worlds, and a generous rivalry in the arts of peace is characteristic of the age. Improvements in railroad machinery made in this city are now introduced extensively in Europe, and especially in Russia, and fire engines, of the admirable description used in Philadelphia, are about to be built at St. Petersburg. The accounts of American patents contained in our journal attract much attention abroad, and we think that the means of securing patents in foreign countries is a subject well worthy to be studied by our inventive fellow citizens.

The Art Union Monthly Journal.

We have received "the Art Union Monthly Journal of the Fine Arts" up to the number for May, 1847. This periodical is published in London, in quarto form, price eighteen pence, and a new and enlarged series began with the present year. It is devoted to the advancement of the fine arts, especially as connected with the useful arts and the various manufactures which are capable of embellishment. The illustrations are numerous and beautiful, comprising both wood-cuts and engravings of a high order of excellence. The whole range of art, from the highest to the lowest, comes within the scope of this journal, and the amount of information which it gives on such subjects can only be appreciated by examining its pages. Its articles on the manufactures of Great Britain are instructive and elaborate, and its suggestions for their improvement are characterized by sound judgment and good taste. The progress of art on the continent of Europe, and particularly in France and Germany, receives much attention, and the latest intelligence on the subject is laid before the English reader. The Art Union Journal is a strenuous advocate for the extensive diffusion of the best designs among all classes, at a cheap rate, so as to cultivate, elevate, and purify the taste of the public at large; and the journal itself is one of the most efficient means of promoting that end.

When such great efforts are made abroad to give to manufactured articles that additional value which is conferred upon them by purity of design, justness of proportion, and good taste in ornament, it is of high importance to American manufacturers that they should not be behind in the race of improvement; and the extensive circulation, among them, of the journal before us, would be of much service in many respects. We cordially commend the work as one well worthy of high praise.

MECHANICS, PHYSICS, AND CHEMISTRY.

Armament for War Steamers.

The Lords Commissioners of the Admiralty, after considerable experience of the power of the various steam frigates and other steamers in the Royal Navy, as regards their capabilities of bearing heavy armaments, have resolved to fix the following as the armament of each particular steamer. Vessels of similar, or nearly similar, tonnage and horse-power, are to be arranged in classes:—

Steamers Propelled by Paddles.

Steam Ships.—Terrible, 1850 tons, 800 horse power; main deck: four 56-pounders of 97 cwt., 11 feet in length; four 8-inch guns of 65 cwt., 9 feet; the 56-pounders on pivot slides, and carriages; the 8-inch guns on common carriages—upper deck: four 56-pounders of 97 cwt., 11 feet, on pivot slides and carriages; four 10-inch guns, 85 cwt., 9 feet 4 inches, on common carriages: total guns, 16. Penelope, 1616 tons, 650-horse power; main deck: eight 8-inch guns of 65 cwt., 9 feet, on slides and carriages; two 68-pounder carronades of 36 cwt., 5 feet 4 inches, on Hardy's compressor carriages—upper deck: two 68-pounders of 95 cwt., 10 feet, on pivot slides and carriages; four 8-inch guns of 65 cwt., 9 feet, on slides and carriages: total, 16. Retribution, 1641 tons, 800-horse power; main deck, none (but it is arranged that all steam ships which do not carry an armament on the main deck shall, if possible, carry four 32-pounders of 56 cwt., for head and stern firing)—upper deck: two 68-pounders of 95 cwt., 10 feet, on slides and carriages to pivot; four 10-inch guns, 85 cwt., 9 feet 4 inches, on slides and carriages: total, 6.

Steam Frigates.—Class 1. Avenger, 1444 tons, 650-horse power; and Birkenhead, of 1400 tons, 500-horse power. Upper deck: two 68-pounders of 95 cwt., 10 feet, on slides and carriages to pivot; four 10-inch guns, 85 cwt., 9 feet 4 inches, on slides and carriages; total, 6. At present the Avenger carries, by way of experiment, two 32-pounders of 65 cwt., instead of two of the 10-inch guns.—Class 2 (A). Odin, 1326 tons, 500 horse power. Main deck: six 32-pounders, 56 cwt., 9 feet 6 inches, on common carriages. Upper deck: two 68-pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 10-inch guns, 85 cwt., 9 feet 4 inches, on slides and carriages; total, 12. The steamers also belonging to this class are the Sidon and the Leopard. Class 2 (B). Gladiator, 1210 tons, 430-horse power; Sampson (450-h. p.); Centaur (540-h.p.); Dragon (560-h.p.); Firebrand (400-h.p.); Vulture (400 h.p.); and Cyclops (320-h.p.). Upper deck: two 68-pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 10-inch guns, of 85 cwt., 9 feet 4 inches, on slides and carriages; total, 6.

Steam Sloops.—1st class, Gorgon, 1111 tons, 320 horse power; Bull-dog (500), Fury (515), Inflexible (378), Devastation (400), Sphynx (500), Cormorant (300), Thunderbolt, since wrecked in Algoa Bay, (300), Virago (300), Eclair (287), Driver (280), Geyser (280), Growler

(280), Styx (280), Vixen (280), Spiteful (280), Stromboli (280), and Vesuvius (280). Upper decks: one 68-pounder of 90 or 95 cwt., 10 feet, and one 10 inch, 85 cwt., 9 feet 4 inches, on pivot slides and carriages. Four 32-pounders of 42 cwt., 8 feet, on Hardy's slides and carriages. Total, for all vessels of this class, 6.—2nd class: Medea, 835 tons, 350 horse power, Salamander (220), Hydra (200), Hecate (240), Hecla (240), Hermes (220), and Trident (350). Upper deck: two 10-inch guns, 65 cwt., 9 feet 4 inches, on pivot slides and carriages. Four 32-pounders, 25 cwt., 6 feet, on Hardy's compressor carriages. Total, 6.—3rd class: Ardent, 810 tons, 200 horse power, Alecto (200), Polyphemus (200), Prometheus (200). Upper deck: one 32-pounder, 45 cwt., 8 feet 6 inches, on pivot slides and carriages. Total, 3. A special exception is made in this class of the Janus, 763 tons, 220 horse power, which carries only two 10-inch guns of 85 cwt., 9 feet 4 inches, on pivot slides and carriages.

Bomb Steamers.—Scourge, 1124 tons, 420 horse power; upper deck, one 68-pounder, 95 cwt., 10 feet, on slide, and carriage to pivot; one 13-inch mortar; total, 2.

Steam Gun-vessels.—Class 1. Firefly, 550 tons, 220 horse power, Blazer (126), Tartarus (136), and Flamer (120). Upper decks: one 32-pounder, 42 cwt., 8 feet, on slide and carriage to pivot. Two 32-pounder carronades, 17 cwt., on Hardy's carriages.—Class 1 (A). Grappler 559 tons, 220 horse power, Pluto (100), Colombia (100), Oberon (260), Triton (260), Antelope (260), Acheron (170), and Volcano (140). Two 32-pounders, 56 cwt., 9 feet 6 inches, on slides and carriages to pivot; two 32-pounders, 25 cwt., 6 feet, on compressor slides and carriages; total, 4.—Class 2 (A). Spitfire, 432 tons, 140 horse power, Porcupine (132), Lucifer (180), Avon (170), Gleaner (130), Shearwater (160), Kite (170), Lightning (100), Meteor (100), and Comet (80). One 18-pounder of 20 cwt., 7 feet, on slides and carriages to pivot; two 18-pounder carronades, 10 cwt., 7 feet, on Hardy's compressor carriages; total, 3.—Class 2 (B). Torch, 345 tons, 154 horse power, Locust (100), Harpy (200), Jackal (150), Lizard (150), Bloodhound (150), and Myrmidon (150). One 18-pounder gun of 22 cwt., 7 feet, on pivot slide and carriage, and two 18-pounder carronades, 10 cwt., 7 feet on Hardy's carriages.

Steam Packets.—Wildfire, 186 tons; Fearless, Dasher, Monkey, and Dwarf. Two 6-pounder brass guns of 6 cwt.

Tugs.—Echo, 295 tons, 140 horse power, African, and Confidence. Two 32-pounders of 56 cwt., 9 feet 6 inches, on pivot slides and carriages.

Troop-ships.—Rhadamanthus, 813 tons, 220 horse power; Dee (220), and Alban (120). Four 32-pounders of 42 or 56 cwt., 8 feet, on common carriages.

Steamers Propelled by Screws.

Steam Frigates.—Class 1. Simoom, 1953 tons, 780 horse power. Main deck: twelve 32-pounders, 56 cwt., 9 feet 6 inches, on slides and carriages. Upper deck: two 68-pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 10-inch guns, 85 cwt., 9 feet 4 inches,

on slides and carriages. Total, 18. Vulcan, 1747 tons, 700 horse power. Main deck: eight 32-pounders, 56 cwt., 9 feet 6 inches, on slides and carriages. Upper deck: two 68-pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 8-inch guns, 65 cwt., 9 feet, on slides and carriages. Total, 14. Termagant, 1556 tons, 620 horse power; Dauntless, 520; Euphrates and Vigilant, 520. Main deck: eighteen 32-pounders, 56 cwt., 9 feet 6 inches, on common carriages. Upper deck: two 68-pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 10-inch guns, 85 cwt., 9 feet 4 inches, on slides and carriages. Total, 24.—Class 2. Megara, 1391 tons, 556 horse power, and Pegasus, 510. Main deck: four 32-pounders, 56 cwt., 9 feet 6 inches, on slides and carriages. Upper deck: two 68 pounders, 95 cwt., 10 feet, on pivot slides and carriages; four 8-inch guns, 65 cwt., 9 feet, on slides and carriages. Total, 10.

Steam Sloops.—Class 1. Conflict, 992 tons, 400 horse power, Desperate, Niger, Enchantress, Falcon, Basilisk, and Florentia. Upper deck: one 68-pounder, 95 cwt., 10 feet; one 10-inch gun, 85 cwt., 9 feet 4 inches, both on pivot slides and carriages; six 8-inch guns, 65 cwt., 9 feet, on slides and carriages; total, 8. Class 2. Encounter, 895 tons, 360 horse power, and Harrier. Upper deck: one 68-pounder, 95 cwt., 10 feet, and one 10-inch gun, 85 cwt., 9 feet 4 inches, both on pivot slides and carriages; four 8-inch guns, 65 cwt., 9 feet, on slides and carriages; total, 6.—Class 3. Rattler, 888 tons, 200 horse power, and Phœnix, 260; one 8-inch gun, 65 cwt., 9 feet; one 32-pounder, 56 cwt., 9 feet 6 inches; four 32-pounders, 25 cwt.. 6 feet, on pivot slides and carriages, or otherwise, if necessary; total, 6.

Steam Gun-boats—1st class. Rifleman, 483 tons, 202 horse power, Sharpshooter, Archer, Parthian, Sepoy, and Cossack; one 68-pounder, 95 cwt., 10 feet, and one 10-inch gun, 85 cwt., 9 feet 4 inches, on pivot slides and carriages; two 32-pounders of 25 cwt., 6 feet, on Hardy's carriages; total, 4.—2nd class. Teazer, 301 tons, 100 horse power, Minx, Boxer, and Biter; one 8-inch gun, 65 cwt., 9 feet, on pivot slide and carriage; one brass 6-pounder; total, 2.

Steam Guard-ships, with Auxiliary Power.—Edinburgh, 1772 tons, 450 horse power, Ajax, Blenheim, and La Hogue. Lower deck: twenty-six 42-pounders, 66 cwt., 9 feet 6 inches, on common carriages. Quarter-deck: two 56-pounders, 87 cwt., 10 feet, on pivot slides and carriages; four 10-inch guns, 85 cwt., 9 feet 4 inches, on slides and carriages. Forecastle: two 56 pounders, 87 cwt., 10 feet, on pivot slides and carriages. Total, 56 guns.—Eurotas, (fr.,) 1168 tons, 350 horse power, Horatio, Seahorse, and Forth. Main deck: twenty 42-pounders, 66 cwt., 9 feet 6 inches, on common carriages. Quarter-deck: one 56-pounder, 87 cwt., 10 feet, on pivot slide and carriage; two 8-inch guns, 65 cwt., 9 feet (or two 10-inch guns of 85 cwt., 9 feet 4 inches), on slides and carriages. Forecastle: one 56-pounder, 87 cwt., 10 feet, on pivot slide and carriage. Total, 24.

Steam Frigates with Auxiliary Power.—Arrogant, 300 horse power. Main deck: twenty-two 32-pounders, 56 cwt., 9 feet 6 inches, and six 8-inch guns, 65 cwt., 9 feet, on common carriages. Quarter-deck: one 68-pounder, 90 or 95 cwt., 10 feet, on pivot slide and car-

riage; sixteen 32-pounders, 32 cwt., 6 feet 6 inches, on Hardy's carriages. Forecastle: one 68-pounder, 90 or 95 cwt., 10 feet, on pivot slide and carriage. Total, 46.—Amphion, 300 horse power. Main deck: fourteen 32-pounders, 56 cwt., 9 feet 6 inches, and six 8-inch guns, 65 cwt., 9 feet, on common carriages. Quarter-deck: one 68-pounder, 90 or 95 cwt., 10 feet, on pivot slide and carriage; eight 32-pounders, 25 cwt., 6 feet, on compression carriages. Forecastle: one 68-pounder, 90 cwt., 10 feet, on pivot slide and carriage. Total, 30.

This return does not include the numerous packets that ply as mail steamers on the various stations round the coast and in our colonial possessions. Civ. Eng. & Arch. Jour.

Copper Wire Rope Lightning Conductors.

(With a Plate.)

Sir,—I herewith send you an abstract sketch and description of my Patent Copper Wire Rope as Lightning Conductors, and ordered to be adopted in the Royal Navy, of which a considerable number of ships have been fitted, besides a much greater number in the merchants' service; the advantage of these conductors consists in their efficiency, economy, and easy application—the perfect continuity, by means of the copper wire line, from the *truck a*, plate v, figs. 6 and 7, at the top-gallant mast-head, passing down the top-gallant mast—then down the *after* top and lower mast shrouds to *c*, below the water-line, as shown on the sectional sketch, which carries the electric fluid clear off the ship, into the water, without injury; the time required for fitting a ship with this conductor is only a few hours, and the expense, including the fitting, is 9d. per foot; if all three masts are fitted, the expenses are about 12*l.* for large class ships—if mainmast only, under 5*l.*—small vessels less in proportion.

The accompanying testimonials, from amongst several, will satisfy you of the efficiency of these conductors:—

Liverpool, August 20, 1842.

Sir,—I have used your Patent Copper Wire Rope Lightning Conductors for three years, and approve of them; the ship I command was struck laying in New York—the electric fluid passed down the conductor to the water, without injury to the spars or hull.

(Signed) J. C. Delano,
Commander of the ship *Patrick Henry*.

Mr. Andrew Smith.

The following is an explanation of the mode adopted in her Majesty's Navy, for the application of Andrew Smith's Patent Copper Wire Rope, as Lightning Conductors, as issued from the Admiralty, Somerset House:

"*Instructions for Fitting Ships of War with Copper Wire Rope, as Lightning Conductors.*—From the truck to the cap of the lower mast-head a wire rope conductor, of three-eighths of an inch in diameter, is to be fitted, secure to the truck, as at *a*, leading down the topmast shroud to the lower mast-head, and in contact with the after

shroud, to the link of the dead eye and ship's side, *d*, whence it is connected to a copper-plate (fig. 8) of 2½ inch broad, three-sixteenths of an inch thick in the middle, rounded off at the edges—inserted into the ship's side; care is to be observed that the edges are well let into the wood, and that the plate is brought into close contact with the copper sheathing on the ship's bottom, extending, at least, to the depth of one sheet below the water-line. The top-gallant mast is to be so fitted with the truck, as to admit of its being struck without the removal of the conductor from aloft, as it may be coiled and left at the top-mast head while the mast is on the deck. The flying jib-boom is not to be fitted in any ship—and in smaller vessels (single deck) the bowsprit need not be fitted."

The annexed certificate has been received from Capt Crawford:—

"The ship *Blakely*, of Liverpool, belonging to Messrs. Taylor, Potter, & Co., left Liverpool in the month of February, 1841, bound to China, fitted with your Copper Wire Rope Lightning Conductor on the main-mast, from the main-top-gallant-mast-head down to the main rail, and from thence to the copper. The captain was made acquainted that the main-mast was protected, but the royal-mast *was not*—and for him, the first opportunity he had, to put the copper wire rope from the conductor to the truck, which he did not do. When the ship arrived off Java Head, she encountered a severe storm of thunder and lightning, which struck the main-royal-mast, and shivered it all to pieces; the lightning then descended by the conductor into the water, to the astonishment of all on board—doing no other damage to the ship. I am happy of having an opportunity of making you acquainted with the circumstances. I hope it will stimulate other ship owners to imitate the house of Messrs. Taylor, Potter & Co., whose ships have all been fitted by me with your Copper Wire Rope Lightning Conductor."

ANDREW SMITH.

Patent Galvanized Iron and Wire Rope Works, Millwall, Poplar, Jan. 27.

Lond. Min. Jour.

Gases and Explosions in Collieries.

Continued from Page 363.

The Committee of 1835 pointed out that more persons had lost their lives from colliery explosions for the 18 years succeeding the introduction of the Davy safety lamp in 1816 than in the 18 years preceding the invention, and accounted for this fact by the working of numerous "fiery" seams of coal, which had, in consequence of the assumed security of that lamp, been undertaken, and by the abandonment of many precautions considered requisite when candles were commonly employed in collieries.

As much doubt has been thrown upon the real safety of the Davy lamp, it is but justice to the memory of Sir Humphrey Davy to state that he was perfectly aware that, if a proper mixture of fire-damp and common air were thrown against the lamp with sufficient force to pro-

ject the flame upon the gauze cylinder, it might communicate with the flame, and cause explosion. Mr. Buddle, in his evidence (Report of Committee of 1835, Nos. 2226 and 2227), clearly shows this to have been the case. He mentions an experiment at Morton West Pit, where a very powerful blower from the shaft was tried with the lamp, when the flame passed and the blower was fired. Sir Humphrey Davy then, addressing Lord Durham, and many other persons who were present, said, "Now, gentlemen, you see the nature of the danger to which you are exposed in using the lamp, and I caution you to guard against it in the manner I have shown you. This is to show the only case in which the lamp will explode; and I caution and warn you not to use it in any such case when you can avoid it without using the shield." The shield recommended was one of tin, inside the cylinder, to prevent a current of fire-damp from acting on the flame. Mr. Buddle stated before the Committee that, in the lamps used in the collieries under his management, the shield, passed from one-half to two-thirds round the inside of the cylinder, and, being bright, reflected the light to such an extent as to be more advantageous than a glass cylinder inside that of wire gauze, a contrivance often recommended to obviate the risk of currents of firedamp.

Dr. Pereira, at the request of the Committee of 1835, experimented upon many lamps before them, and passed the flame through all those tested, except that of Messrs. Upton and Roberts. The experiments have been repeated at the Museum of Economic Geology, by Dr. Pereira and by ourselves, with the ordinary Davy lamp, and with the same results.

There can, therefore, be very little doubt that the flame can pass, and explode fire-damp adjacent, if the current be sufficiently strong, and no protection be afforded either by a metallic shield or by an internal glass cylinder. The question as to the amount of current required seems not so well ascertained. Mr. Buddle considered that the blowers would rarely be found strong enough. Mr. Stephenson supposed that many accidents may have happened by the falling of the roof producing a sudden rush of explosive fire-damp. It will be obvious that the same effect might be produced by the careless swinging of the lamp with the required velocity through an explosive mixture of fire-damp and air, or from the lamp being so jerked out of a collier's hand, by an unlucky fall, that the cylinder presented the necessary front to the same compound.

Without desiring, in the slightest degree, to cast unnecessary doubt on the safety of the Davy lamp, since we consider its cautious use an immense boon to coal mining, and believe that much additional security is obtained by the proper use of the original Davy, or of its improvements, it can scarcely be denied that far more care in the use of safety lamps is needed than is commonly employed. Although shields or glass cylinders are used in some localities, they are never employed in others; and the bare single cylinder of wire gauze, not always properly manufactured, is the only form in which the Davy lamp is known. And it should be observed that, with a few local exceptions, the Davy amp is that commonly employed. Numerous modifications, and in

some cases improvements, of the safety lamp have been made, but, either from the expense, or want of simplicity in management, have never come generally into use.

The colliers, by their usual mode of carrying the common Davy lamp, certainly, under ordinary circumstances, guard against the passage of any current of fire-damp sufficiently strong to pass the flame, by placing the lamp within their jacket flaps, or carefully protected in some other manner. Abundant carelessness is often, however, apparent; and, when the collieries are viewed as a whole, unnecessary risk is too common, especially when it is recollected that the fool-hardiness or carelessness of one may destroy the lives of many.

To those who have, during many years, had occasion to visit collieries in different parts of Great Britain, the thoughtless daring of many of our colliers, and their frequent carelessness under danger, must be familiar. They will often, in an endeavor to execute more work in a given time, when paid by the ton or piece, remove the covers of their lamps, or employ a candle at a risk. Some even prefer a candle to ascertain the presence of fire-damp, since by it they more readily see the change in the flame. In many districts, though in some they are anxious to employ the safety lamp, it requires much trouble on the part of managers to prevent the continued use of candles in suspected places before the danger becomes known to them. The less light afforded by lamps is considered a great drawback to their use when it can be avoided. Many most careful men, no doubt, anxiously watch over the common danger, and great precautions are taken by many coal owners and workers; but looking at the subject generally, and without reference to many exceptions, especially to be found in the north of England, the want of system in the management of lights, and in due precautions respecting the kinds employed, can scarcely escape the observation of those whose opportunities have been sufficiently extended.

When we consider that the safety lamps have now been in use for so many years, causing security in all cases where proper care is employed, although they may not be absolutely safe under unusual circumstances, their utility appears sufficiently sanctioned by experience to make them the subject of legislative enactment. The evils complained of in the modifications of the Davy lamp are, that, while they add to the security, they diminish so much the amount of light, as to render them practically useless. These are described in the report of the Select Committee referred to. A new modification of Dr. Clanny's lamp, invented since then, is not subject to this fault, and in principle is an elegant application of the safety lamp, and consists of a wire-gauze cylinder, having beneath a thick glass cover to the lamp, which only ascends till it meets with the gauze; the thickness of this glass is supposed to free it from accidents, and, whilst strong enough to bear a considerable blow, it is sufficiently well annealed to resist sudden changes of temperature. But whether, in a manufacture so uncertain as glass, these conditions can always be attained, is questionable, and at all events has not been sufficiently tested by experience to induce the coal owners to employ this lamp in their mines.

It has been at various times proposed, during the last eight years, to employ electricity as a means of lighting collieries. The electricity, streaming between two charcoal points from a Grove's or a Bunsen's battery, affords a light of much beauty, and perfectly safe if completely surrounded by glass, but capable of igniting an explosive mixture if exposed. Professor Grove has constructed a lamp on this principle, which he kindly prepared for us, and which we have examined in action. It consisted of a box, containing four galvanic cells, and the light was obtained by the passage of electricity between two coils of platinum wire. These were surrounded with glass vessels; the inner one for the purpose of isolation, the exterior one being filled with water, so as to destroy the light, should the inner glass vessel be broken. The light given out was rather more than that of a miner's candle. This, certainly, is a safe lamp, but in its present state still unfitted for the purpose of the collier as at present arranged. The acids, sulphuric and nitric, render the lamp so inconveniently heavy, that both hands must be used in carrying it; besides, from not being covered, the spilling of these corrosive liquids on the persons of the miners could scarcely be avoided. The water in the external vessel soon becomes heated, and ultimately boils, and the light only lasts in proper strength for two or three hours. There must, therefore, be considerable modification in this lamp before it can be rendered available for ordinary mining purposes, which we may readily expect, from the acknowledged talent of its inventor.

The means of obtaining the needful lights in collieries, though most important, would still appear subordinate, as has, indeed, been before remarked, to such a system of ventilation as should not expose men in such large portions of a colliery as is now frequently the case, to the risk of death from explosion, (the greater proportion, and often all, perishing from the carelessness of one man,) or to unforeseen accidents under the greatest precautions in the use of lights. The too common use of single shafts in collieries, in cases where others might have been sunk, the single shaft divided into two or three portions by wooden partitions named *brattices*, a down current of pure air descending through one division, and the foul air from the colliery workings rising up through another, has often been reprobated. The Committee of the House of Commons of 1835, and many important witnesses examined, animadvert upon this practice; and the bad effects of this system are pointed out by the South Shields Committee in their report of 1843.

In a single shaft, as has often been remarked, the ventilation may be cut off from the workings of a whole colliery in an instant by an explosion sufficient to destroy the doors or partitions directing the air-courses, the air merely going down one division in the shaft and rising through another, when the brattices may not be destroyed by the explosion, and a kind of draught kept up. Thus all not destroyed by the explosion perish in the mixture of nitrogen and carbonic acid, known as after-damp, to which no fresh air can reach. In the explosion at Jarrow Colliery there was only a single shaft communicating with the workings upon two beds of coal one above the other, and the

lower part of the brattice in the shaft was so shattered by the late explosion in it, that Dr. Playfair and Mr. Williams, in their descent into the pit, then containing a large amount of fire-damp, had to be let down a considerable distance by a loop in a rope. In this explosion the upper portion of the brattice fortunately remained, and thus the lives of many of those engaged in the upper workings were saved, although several perished.

Even in a double shaft, or two shafts not far distant from each other, if the air be not made to course for a considerable distance amid the workings by a firm thick parting of coal, any needful perforation in the parting for the progress of the colliery being firmly built up, a whole mass of workings may, by an explosion, be suddenly cut off from ventilation, and numbers of persons, not killed by the explosion, perish by the after damp. This was the case at the late explosion at Risca. It should, however, in this instance, be observed, that the colliery was, as regards ventilation, in a transition state, a more perfect arrangement for ventilation being in progress.

Great improvements were introduced in the ventilation of collieries in many districts, when the course of air was quickened by means of a furnace established near the bottom of the upcast shaft, or that through which the foul air passes outwards, and more particularly when, in the north of England, instead of permitting the air introduced by the downcast shaft to pass slowly and imperfectly along a course of 20 or 30 miles of passages, it was split or divided into separate courses, from two to six miles in length. Those, however, who may possess an extended acquaintance with our collieries in different parts of the country cannot but be aware, that, as a whole, their general ventilation is very imperfect, good as it may be in some collieries, particularly in some districts.

When it is considered that coals are worked in the United Kingdom under every variety of condition,—from levels driven into mountain sides to pits sunk to great depths through masses of superincumbent rocks,—in beds ranging from a vertical to a horizontal position, and even contorted and bent,—sometimes traversed by faults, at others free from them,—the beds near the surface in one place, and ranging beneath mountains in another,—in fact, under a great variety of geological conditions, it is not difficult to see that many plans which have been suggested for the working of collieries, good as they may be for some localities, would be inapplicable generally, and would indeed fail, except under the conditions fitted for them.

So various are the conditions under which collieries are or can be worked in the United Kingdom, that we would suggest for consideration, if legislative measures should be deemed advisable, and an extension of the principle which regulates the employment of women and children in our mines, and the labor in our factories, be thought good, that effective discretionary powers should be vested in properly qualified persons, appointed in convenient districts, so that the needful adjustments to conditions may be effected, and no single system be attempted inapplicable to our collieries as a whole.

Any general system of legislation for conditions so different could

only be productive of failure or of injurious consequences, both to owners and workers; but a local examination and inquiry, with power to adjust to special conditions, would, we apprehend, remove the difficulties which the legislature has felt in dealing with interests so important.

Jealous as the coal owners should properly be of any undue intermeddling with their collieries, it may nevertheless be true that a judicious system of superintendence in a district, by which the proper ventilation of collieries, efficient knowledge on the part of subordinate agents, and proper punishment for fool-hardiness or carelessness on the part of the colliers may be secured, would be a great advantage to them individually and collectively, and be the saving not only of lives but of much capital, securing them, in the case of accidents, from many an unjust accusation for neglect.

On the other hand, careful but not overmeddling supervision would afford confidence to the collier. Proper persons being appointed as superintendents, (and, if improper, their deficiencies would soon become apparent, and their removal the consequence,) he would feel that he has the advantage of the existing knowledge of the day brought to bear upon the particular conditions under which the colliery in which he labors is worked. In some districts the working collier is far better informed upon the general principles which should receive attention than may be commonly supposed, and he would feel far more secure from danger than he now does, if assured that the State was not neglectful of his safety.

Though several collieries in particular districts possess good plans and sections of their workings, and an inspection of such plans and sections affords a view of the system of ventilation and general mode of working adopted, this is far from being the case generally, and has been much regretted alike by the enlightened coal owners and by the public. The importance of correct plans and sections has been prominently pointed out, both by the Committee of the House of Commons of 1835, and in the report of the South Shields Committee of 1843; indeed, the necessity of them is sufficiently obvious.

Should the suggestion of a system of judicious inspection be considered worthy of consideration, the ready access to proper plans and sections of collieries, brought up to given times, would necessarily form a part of any general system of regulations. If correct, (and power to ascertain that they were so would be essential,) they would at once disclose the system of working and ventilation adopted, and, with information respecting the police regulations, and an account of the kind of lights employed, would at once afford a general view of the mode of conducting any particular colliery, and of the adjustment of the workings to conditions.

It being considered that safety lamps, properly used, do effect much security in the working of coal, and that in so many cases explosions do take place when they are not employed, it has often been suggested that the Legislature should compel the general use of safety lamps in coal mines. But, on the other hand, there are many collieries in

which fire-damp never appears, and it would justly be considered a hardship in such cases to compel a precaution altogether unnecessary.

We would suggest that it could not be considered unjust for the Legislature to compel the use of safety lamps in all fiery collieries; and, in the present state of the law of property, it might even be prudent to assume that all collieries, in districts where explosions have been frequent, are fiery, putting the *onus probandi* that they are not, upon the owners of such collieries. If proved to the satisfaction of the inspectors that no reasonable danger was to be apprehended in their collieries, license might be given for them to work with naked candles, this license ceasing at short periods, but being renewable on ascertaining that the conditions of the mine had not altered.

Careful investigations into the causes of explosions in collieries, only part of which arrest public attention by their magnitude, appear to have led to the very general conclusion that the condition of our collieries is most unequal. While, in some localities, there is so little to improve that it becomes a subject of regret that such examples should not more generally be followed, in others it becomes a matter of surprise how the works can be permitted to remain in so defective a state, seeing that the owners themselves suffer much loss thereby. Under such a state of things, and considering the number of valuable lives annually lost by colliery explosions, the continued risk to which so many are daily exposed, the national injury sustained by the imprudent and careless mode of extracting coal in many localities—one often felt oppressively, also, by the parties engaged in colliery speculations—and that the workings for coal must be adjusted to local conditions, we are led to consider that these evils might be at least mitigated by the careful and judicious inspection of convenient districts by competent persons, the necessary funds to be raised from such districts by a very slight impost, not even exceeding one farthing on each ton of coal raised in it; and we believe that the cause of humanity, and the interests of the coal owners would be alike benefited by a well-considered legislative measure of this kind.

We have, &c., H. T. De La Beche,
Lyon Playfair.
Civ. Eng. & Arch. Jour.

New Preparation of Paper. *By* Professor Schoenbein.

Extract of a letter from M. Schoenbein to M. Dumas, dated 28th March, 1846.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The author has discovered a method by means of which the following properties may be given to the paper in common use:—

1. Prepared paper has much more tenacity and greater consistency than common paper.

2. When dipped into water, it does not lose its consistency, but is affected as parchment would be.

3. It receives, with equal facility, both writing and printing ink.

4. It does not require sizing to render it suitable either for writing or printing.

5. The injurious effects produced by the chloride of lime are avoided in prepared paper.

M. Schoenbein states that his process is simple, inexpensive, and easy of application, and that the new paper offers many advantages, particularly for bank-notes and for paper-hangings.

The vegetable fibre of this paper renders it possible to make of it a substance as transparent as glass, and impermeable to water. The author has made of it, bottles, balloons, &c., the sides of which may be made as thin as a plate of mica.

Another property of this paper is, that it developes a very energetic electric force. By placing some sheets on each other, and simply rubbing them once or twice with the hand, it becomes difficult to separate them. If this experiment is performed in the dark, a great number of distinct flashes may be perceived between the separated surfaces. The disk of the electrophorus, placed on a sheet that has been rubbed, produces sparks of some inches in length. A thin, and very dry, sheet of the paper, placed against the wall, will adhere strongly to it for several hours if the hand is passed only once over it. If the same sheet is passed between the thumb and fore-finger, in the dark, a luminous band will be visible. Hence, it is believed, that this prepared paper will answer to make powerful and cheap electrical machines.

Explosion from Fire Damp.

Dr. Miller, of H. M. St.-V. *Sidon*, dating from Greenhithe, Dec. 12, sent the following in a letter to the *Times*:—"Explosions from Fire-Damp, or carburetted hydrogen, on board of steam-ships being very rare, and the possibility of so serious an occurrence not generally known; I have to state that a violent explosion of this nature took place on board the *Sidon*, early this morning. The after-midship coal tank contained about sixty tons of coal, and the second engineer having removed the cover, he introduced a lamp into the tank, when the explosion immediately took place. The engineer had his face and hands severely burnt, and three other persons were injured, but not seriously." We believe the fire-damp was generated by the coal bunkers having been filled with water by order of Sir C. Napier, after the coals had been consumed, when the Sidon was towed down the river with the Lords of the Admiralty on board.

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